NATIONAL MARINE FISHERIES SERVICE
ENDANGERED SPECIES ACT SECTION 7 CONSULTATION
BIOLOGICAL OPINION

AGENCY:	Bureau of Ocean Energy Management Bureau of Safety and Environmental Enforcement National Marine Fisheries Service, Office of Protected Resources U.S. Army Corps of Engineers U.S. Coast Guard U.S. Environmental Protection Agency
ACTIVITY CONSIDERED:	Construction, Operation, Maintenance, and Decommissioning of the SouthCoast Wind Offshore Energy Project (Lease OCS-A 0521) GARFO-2024-01317
CONDUCTED BY:	National Marine Fisheries Service Greater Atlantic Regional Fisheries Office
DATE ISSUED:	November 7, 2024
APPROVED BY:	________________________ Michael Pentony Regional Administrator

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1.0 INTRODUCTION

This constitutes NOAA's National Marine Fisheries Service's (NMFS) biological opinion (Opinion) issued to the Bureau of Ocean Energy Management (BOEM), as the lead federal agency, in accordance with Section 7 of the Endangered Species Act of 1973 (ESA), as amended, on the effects of its proposed approval with conditions of the Construction and Operation Plan (COP) authorizing the construction, operation, maintenance, and decommissioning of the SouthCoast Wind offshore wind energy project under the Outer Continental Shelf Lands Act (OCSLA). The applicant and lessee, SouthCoast Wind, LLC, (SouthCoast Wind or SouthCoast) is proposing to construct, operate, and eventually decommission a commercial-scale offshore wind energy facility within Lease Area OCS-A 0521 that would generate up to approximately 2.4 gigawatts of electricity and consist of up to 147 wind turbine generators (WTGs), up to five offshore substation platforms (OSPs), and associated inter-array cabling as well as two export cable corridors (ECCs) to bring electricity to land in Massachusetts.

BOEM is the lead federal agency for purposes of Section 7 consultation; the other action agencies include the Bureau of Safety and Environmental Enforcement (BSEE), the U.S. Army Corps of Engineers (USACE), the U.S. Coast Guard (USCG), the U.S. Environmental Protection Agency (EPA), and NMFS Office of Protected Resources[1] each of whom is taking action under their respective statutory and regulatory authorities related to approval of the COP and its conditions and therefore have corresponding ESA Section 7 consultation responsibilities. This Opinion considers effects of the actions proposed by these federal action agencies and described below (collectively referred to in this Opinion as the proposed action) on ESA-listed species and designated critical habitat that occur in the action area (as defined in Section 3.0 *Description of the Proposed Action* of this Opinion). A complete administrative record of this consultation will be kept on file at our Greater Atlantic Regional Fisheries Office.

1.1 Regulatory Authorities

The Energy Policy Act of 2005 (EPAct), Public Law 109-58, added section 8(p)(1)(c) to the Outer Continental Shelf Lands Act (OCSLA). This authorized the Secretary of Interior to issue leases, easements, and rights-of-way (ROW) in the Outer Continental Shelf (OCS) for renewable energy development, including wind energy. The Secretary delegated this authority to the former Minerals Management Service, and later to BOEM. Final regulations implementing this authority (30 CFR part 585) were promulgated on April 22, 2009 and amended in 2023. These regulations prescribe BOEM's responsibility for determining whether to approve, approve with modifications, or disapprove a lessee's Construction and Operations Plan (COP). SouthCoast Wind filed their COP with BOEM on February 16, 2021, with subsequent updates in August, 2021, October, 2021, March, 2022, August, 2022, December, 2022 and September, 2023[2].

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[1] The NMFS Office of Protected Resources (OPR), located in NMFS' Silver Spring, MD, Headquarters (HQ) Office, is proposing to issue an Incidental Take Authorization under the MMPA and is thus an action agency responsible for consulting under Section 7 of the ESA, whereas NMFS's Gloucester, MA, Greater Atlantic Regional Fisheries Office (GARFO) is the consulting agency, under ESA regulations at 50 C.F.R. part 402.

[2] The September 2023 COP and appendices are available online at: https://www.boem.gov/renewable-energy/state-activities/southcoast-wind-formerly-mayflower-wind

BOEM issued a Notice of Intent to prepare an Environmental Impact Statement (EIS) under the National Environmental Policy Act (NEPA) (42 USC § 4321 et seq.) on November 1, 2021, to assess the potential biological and physical environmental impacts of the Proposed Action and Alternatives (86 FR 22972) on the human environment. A draft EIS (DEIS) was published on February 13, 2023.[3]

BSEE's mission is to enforce safety, environmental, and conservation compliance with any associated legal and regulatory requirements during project construction and future operations. BSEE will be in charge of the review of Facility Design and Fabrication and Installation Reports (FRD/FIR), oversee inspections/enforcement actions as appropriate, oversee closeout verification efforts, oversee facility removal inspections/monitoring, and oversee bottom clearance confirmation. The reorganization of the Renewable Energy rules [30 CFR Parts 285, 585, and 586] enacted on January 31, 2023) reassigned existing regulations governing safety and environmental oversight and enforcement of OCS renewable energy activities from BOEM to BSEE. BSEE is responsible for enforcing safety, environmental, and conservation compliance with any associated legal and regulatory requirements during project construction and future operations. Additionally, BSEE will: oversee inspections/enforcement actions, as appropriate; oversee closeout verification efforts; oversee facility removal and inspections/monitoring; oversee bottom clearance confirmation and provide analysis of the facility design report (FDR) and fabrication and installation report (FIR) and other project-related plans for operations, safety, and environmental protection. A lessee may not commence fabrication or installation of facilities until the lessee resolves all objections to the FDR or FIR to BSEE's satisfaction, if BSEE communicates objections (30 CFR 285.700(a)-(c)). BSEE's actions and activities are included as elements of the proposed action in this Opinion.

EPA is proposing to issue an OCS Air Permit to SouthCoast Wind, LLC for the SouthCoast Wind project. The EPA is proposing to issue the OCS air permit pursuant to section 328 of the Clean Air Act (CAA) and applicable rules and regulations promulgated under 40 C.F.R. part 55. On November 23, 2022, EPA received the OCS air permit application. EPA determined the application to be administratively complete on April 7, 2023 but as of the date of issuance of this Opinion no draft permit has been published for public comment. EPA anticipates including emission limits, operating requirements and work practices, and testing, recordkeeping, and reporting requirements. Anticipated air emission sources are the marine vessels to be used to support construction and operation/maintenance, and any generators or other emission sources at the WTGs and OSPs. As noted on the FAST-41 dashboard, EPA is planning to issue a final decision/permit approval by February 25, 2025. EPA's OCS Air permit is included as an element of the proposed action in this Opinion.

EPA is proposing to issue a National Pollutant Discharge Elimination System (NPDES) permit pursuant to section 402 of the Clean Water Act for the HVDC Offshore Substation Platform for Project 1 and may propose to issue a second NPDES permit for Project 2 if an HVDC is used for that project as well. SouthCoast Wind filed a NPDES permit application for the HVDC

Last accessed July 10, 2024.

[3] The DEIS is available online at: https://www.federalregister.gov/documents/2023/02/17/2023-03271/notice-of-availability-of-a-draft-environmental-impact-statement-for-southcoast-wind-energy-llcs
Last accessed July 10, 2024.

converter OSP for Project 1 on October 31, 2022 and submitted a revised application in August 2023. EPA determined the application was complete on September 29, 2023. In the BA, BOEM indicates that if SouthCoast Wind uses HVDC technology for Project 2, the parameters and modeling results from the NPDES permit application are representative of a second HVDC converter OSP for Project 2 within the Lease Area. A draft NPDES permit for "Offshore Converter Station #1" was published for public comment by EPA Region 1 on October 3 (MA0006018).[4] EPA's NPDES permits are included as elements of the proposed action in this Opinion.

USACE issued a Public Notice (NAE-2020-00958[5]) on February 17, 2023, describing its consideration of SouthCoast Wind's request for a permit authorization pursuant to Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403) and Section 404 of the Clean Water Act (33 U.S.C. 1344) on April 4, 2023. As described in the Public Notice, the applicant proposes to develop the SouthCoast Wind project to construct up to 149 positions within the OCS-A-0521 lease area including up to 147 WTGs and up to five OSPs; installation of submarine array cables between WTGs and OSPs; and two offshore ECCs with associated landings in Falmouth, MA and Somerset, MA. Each ECC would provide up to 1,200 megawatts of power to the Massachusetts grid. USACE's permit is included as an element of the proposed action in this Opinion.

The USCG administers the permits for private aids to navigation (PATON) located on structures positioned in or near navigable waters of the United States. PATONS and federal aids to navigation (ATONS), including radar transponders, lights, sound signals, buoys, and lighthouses are located throughout the Project area. It is anticipated that USCG approval of PATONs during construction of the WTGs, OSPs, and along the offshore export cable corridor may be required. These aids serve as a visual reference to support safe maritime navigation. Federal regulations governing PATON are found within 33 CFR part 66 and address the basic requirements and responsibilities. USCG's proposal to permit installation of additional aids to navigation is included as an element of the proposed action in this opinion.

BOEM indicated it will require, through COP approval, all Project construction vessels to adhere to existing state and federal regulations related to ballast and bilge water discharge, including USCG ballast discharge regulations (33 CFR §151.2025) and EPA National Pollutant Discharge Elimination System (NPDES) Vessel General Permit standards.

The Marine Mammal Protection Act of 1972 (MMPA) as amended, and its implementing regulations (50 CFR part 216) allow, upon request, the incidental take of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographic region assuming certain statutory and regulatory findings are made. To "take" is defined under the MMPA (50 CFR§ 216.3) as,

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[4] Public notice is online at https://www.epa.gov/ma/draft-permit-southcoast-wind-farm-offshore-converter-station-1-boem-renewable-energy-lease-area; Last accessed October 17, 2024

[5] Public Notice is online at https://www.nae.usace.army.mil/Portals/74/docs/regulatory/PublicNotices/2023/NAE-2020-00958.pdf
Last accessed July 11, 2024.

> to harass, hunt, capture, collect, or kill, or attempt to harass, hunt, capture, collect, or kill any marine mammal. This includes, without limitation, any of the following: The collection of dead animals, or parts thereof; the restraint or detention of a marine mammal, no matter how temporary; tagging a marine mammal; the negligent or intentional operation of an aircraft or vessel, or the doing of any other negligent or intentional act which results in disturbing or molesting a marine mammal; and feeding or attempting to feed a marine mammal in the wild.

"Incidental taking" means "an accidental taking. This does not mean that the taking is unexpected, but rather it includes those takings that are infrequent, unavoidable, or accidental." (50 C.F.R. §216.103). NMFS Office of Protected Resources (OPR) has received a request for Incidental Take Regulations (ITR) and associated Letter of Authorization (LOA) from SouthCoast Wind, LLC, for the incidental take of small numbers of marine mammals during the construction of the SouthCoast Wind offshore wind project.[6] The requested ITR would govern the authorization of take, by both Level A and Level B harassment[7], of "small numbers" of marine mammals over a 5-year period incidental to construction-related pile driving activities (impact and vibratory), detonation of unexploded ordnances or munitions and explosives of concern (UXO/MEC), and high-resolution geophysical (HRG) site characterization surveys conducted by SouthCoast Wind in Federal and State waters off of Massachusetts. A final ITR would allow for the issuance of a LOA to SouthCoast Wind for a 5-year period. NMFS OPR's issuance of an ITR and LOA is included as an element of the proposed action in this Opinion.

SouthCoast Wind may choose to obtain a Letter of Acknowledgment from NMFS for certain fisheries survey activities. A Letter of Acknowledgement acknowledges, but does not authorize, certain activities as scientific research conducted from a scientific research vessel. (See 50 CFR §600.745(a)). Scientific research activities are activities that would meet the definition of fishing under the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), but for the statutory exemption provided for scientific research. (16 USC § 1802(16)). Such activities are statutorily exempt from any and all regulations promulgated under the Magnuson-Stevens Act, provided they continue to meet the definition of scientific research activities conducted from a scientific research vessel. To meet the definition of a scientific research vessel, the vessel must be conducting a scientific research activity and be under the direction of one of the following: Foreign government agency; U.S. Government agency; U.S. state or territorial agency; University (or other educational institution accredited by a recognized national or international accreditation body); International treaty organization; or, Scientific institution. In order to meet this definition, vessel activity must be dedicated to the scientific research activity, and cannot include commercial fishing. Scientific research activity, for Magnuson-Stevens Act purposes, includes, but is not limited to, sampling, collecting, observing, or surveying the fish or fishery resources within the Exclusive Economic Zone. Research topics

[6] Application, Notice of Receipt of Application, Proposed Rule, and Supporting Materials are available online at: https://www.fisheries.noaa.gov/action/incidental-take-authorization-southcoast-wind-llc-construction-southcoast-wind-offshore-wind; Last accessed July 11, 2024.

[7] Level A harassment means any act of pursuit, torment, or annoyance that has the potential to injure a marine mammal or marine mammal stock in the wild. Level B harassment refers to acts that have the potential to disturb (but not injure) a marine mammal or marine mammal stock in the wild by disrupting behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering.

include taxonomy, biology, physiology, behavior, disease, aging, growth, mortality, migration, recruitment, distribution, abundance, ecology, stock structure, bycatch or other collateral effects of fishing, conservation engineering, and catch estimation of fish species considered to be a component of the fishery resources. The issuance of a Magnuson-Stevens Act related Letter of Acknowledgment by NMFS is not a federal action subject to Section 7 consultation, and it is not an authorization or permit to carry out an activity and the issuance of LOA's, should they be requested, is not considered an action funded, authorized or carried out by a Federal agency that may affect ESA listed species or critical habitat and is thus not an element of the proposed action in this opinion. However, BOEM's action we are consulting on includes proposals to conduct fisheries surveys following issuance of this opinion in connection with approval of the SouthCoast Wind project that may be carried out with a Magnuson-Stevens Act Letter of Acknowledgement. These surveys and their effects would not occur but for the SouthCoast Wind project proposed in the COP upon which BOEM intends to act under OCSLA, we therefore consider them to be consequences of BOEM's proposed action assessed in this Opinion and, to the extent the surveys may cause effects to listed species at a level resulting in the incidental take of ESA-listed species, address such take in this Opinion's Incidental Take Statement.

2.0 CONSULTATION HISTORY AND APPROACH TO THE ASSESSMENT

As explained above, BOEM is the lead federal agency for this Section 7 consultation. BOEM submitted a draft Biological Assessment (BA) on October 21, 2022, as the lead federal agency for the ESA consultation and on behalf of BSEE, USACE, EPA, and the USCG; this BA also acknowledged NMFS OPR's anticipated issuance of a proposed MMPA ITA. A number of revised BAs were submitted after October 2022, including: March 2023, August 2023, February 2024, and May 2024. A final BA and accompanying request for consultation was sent by BOEM on behalf of BSEE, USACE, EPA, and USCG on June 4, 2024. Note that in February 2023, the name of the Project was changed from Mayflower Wind to SouthCoast Wind.

On June 10, 2024, we received a draft *Notice of Proposed Incidental Take Regulations for the Taking of Marine Mammals Incidental to the SouthCoast Offshore Wind Project*, from NMFS Office of Protected Resources (OPR) and an accompanying request for ESA Section 7 consultation. On June 27, 2024, OPR submitted to us the published proposed rule (89 FR 53708) and draft LOA[8].

On June 10, 2024, we deemed the information submitted by BOEM and NMFS OPR sufficient to assess the effects of the proposed action on ESA-listed species and designated critical habitat and that the information constituted the best scientific and commercial data available (50 CFR §402.14(c)(-(d)); ESA formal Section 7 consultation was initiated on that date. To harmonize various regulatory reviews, increase certainty among developers regarding anticipated regulatory timelines, and allow sufficient time for NMFS' production of a final biological opinion, BOEM and NMFS have agreed to a standardized ESA Section 7 consultation timeline under the offshore wind program that allocates 150 days for consultation and production of a biological opinion for

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[8] Available at *https://www.fisheries.noaa.gov/action/incidental-take-authorization-southcoast-wind-llc-construction-southcoast-wind-offshore-wind*

each proposed offshore wind project, unless extended. In this case, the identified deadline for issuance of the Opinion is November 7, 2024.

Consideration of Activities Addressed in Other ESA Section 7 Consultations
As described in Section 3 *Description of the Proposed Action* below, some SouthCoast project vessels will utilize the Nexans Cable Plant in Goose Creek, Charleston, SC. NMFS SERO completed ESA Section 7 consultation with the USACE for the construction and operation of the Nexans Cable Plant. The Biological Opinion prepared by NMFS SERO for the Nexans facility (May 4, 2020, "2020 Nexans Opinion") considered the effects of construction activities as well as effects of all vessels transiting the Cooper River in Charleston, SC to/from the Nexans facility on ESA listed species that occur in that area and critical habitat designated for the Carolina DPS of Atlantic sturgeon.

The Nexans Opinion analyzed an overall amount of vessel transits of which SouthCoast would contribute a small part. The effects analyzed in the Nexans Opinion will be considered as part of the *Environmental Baseline* of this Opinion, given the definition of that term at 50 CFR §402.02. The effects specific to SouthCoast's vessel use of the cable facility will be discussed in Section 7.0 *Effects of the Action* by referencing the analysis in the Nexans Opinion and determining whether the effects of SouthCoast's vessels transiting to and from the facility are consistent with the analyses or anticipated to cause additional or different effects. In Section 11.0 *Integration and Synthesi*, if we determine any additional or different effects of SouthCoast's vessels will be caused by the proposed action, we will evaluate them in addition to the effects included in the *Environmental Baseline*, which already includes the effects of vessel transits analyzed in the completed Nexans Opinion.

By using this methodology, this Opinion ensures that all of the effects of SouthCoast's vessel transits to and from the Nexans facility will be considered in Section 11.0 *Integration and Synthesis* and reflected in this Opinion's final determination under ESA 7(a)(2). This methodology also ensures this Opinion does not "double-count" effects of SouthCoast's vessel transits to and from the facility– once in Section 6.0 *Environmental Baseline* and then again in Section 7.0 *Effects of the Action*. This approach is being taken because BOEM was not a party to the Nexans Biological Opinion, yet SouthCoast's vessel transits would not occur but for BOEM's COP approval. Therefore, it is reasonable, necessary and appropriate to specify this incidental take, as well as any non-discretionary measures to minimize, monitor, and report such take, in this Opinion's Incidental Take Statement (ITS) that will apply to the relevant action agencies identified in this Opinion and the ITS.

Consideration of the 2024 ESA Section 7 Regulations
On April 5, 2024, NMFS and the U.S. Fish and Wildlife Service (FWS) (the Services) published joint final revisions to the 2019 Section 7 regulations in the Federal Register (89 FR 24268). These updates to the regulations governing interagency consultation (50 CFR part 402) were effective on May 6, 2024. We are applying the updated regulations to this consultation. The 2024 regulatory changes, like those from 2019, were intended to improve and clarify the consultation process, and, with one exception from 2024 (offsetting reasonable and prudent measures), were not intended to result in changes to the Services' existing practice in implementing section 7(a)(2) of the Act (89 FR 24268; 84 FR 45015). We have considered the

prior rules and affirm that the substantive analysis and conclusions articulated in this Biological Opinion and its Incidental Take Statement would not have been any different under the 2019 regulations or pre-2019 regulations.

3.0 DESCRIPTION OF THE PROPOSED ACTIONS ON WHICH CONSULTATION WAS REQUESTED

In this section and throughout the Opinion we use a number of different terms to describe different geographic areas for reference. For clarity, we define those terms here. The Wind Development Area (WDA) is the area consisting of the location of the wind turbine generators (WTGs), offshore substation platforms (OSPs), inter-array cables (IAC), and the export cable corridors (ECCs) to the landfall sites in Massachusetts (Somerset and/or Falmouth). The Wind Farm Area (WFA) is a subset of the WDA and is that portion of the SouthCoast Wind lease area (OCS-A 0521) where the WTGs and OSPs will be installed and operated (i.e., the offshore portion of the WDA minus the cable routes to shore); in this case, the SouthCoast Wind WFA and lease area OCS-A 0521 are nearly co-extensive and we may use these terms interchangeably in this Opinion. The action area is defined in Section 3.9 below and includes the WDA (and WFA which is nearly coextensive with the lease area) as well as the portion of the U.S. EEZ used by project vessels including project vessels transiting to/from foreign ports.

3.1 Overview of SouthCoast Project

As explained above, BOEM is the lead federal agency for the project for purposes of this ESA consultation. The proposed action described in the BA consists of the proposed approvals, permits, and authorizations for SouthCoast Offshore Wind Project located in Lease Area OCS-A 0521. In addition to BOEM's proposed approval of SouthCoast Wind's COP for the SouthCoast Wind Project, BOEM's June 2024, request for consultation also included: EPA's proposal to issue an Outer Continental Shelf Air Permit; the USACE's proposal to issue a permit for in-water work, structures, and fill under Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act; and the USCG proposal to issue a Private Aids to Navigation (PATON) Authorization. BOEM also identified the role of the Bureau of Safety and Environmental Enforcement (BSEE) in taking actions related to the project and NMFS OPR's proposal to issue a Marine Mammal Protection Act (MMPA) Incidental Take Authorization (ITA). NMFS OPR submitted a separate request for consultation in June 2024. No proposed Federal action by any Federal agency other than those described above is included within the scope of this consultation and Opinion.

The information presented here reflects the proposed action described by BOEM in their June 2024 final BA and the proposed Marine Mammal Protection Act Incidental Take Authorization (89 *Federal Register* 53708; June 27, 2024) as well as additional clarifying information provided by BOEM and OPR during the consultation period. Here, for simplicity, we may refer to BOEM's proposed action when that proposed action may also include other federal actions (e.g., construction of the wind turbines requires authorizations from BOEM, USACE, EPA, USCG, and NMFS OPR). This section provides a summary of the proposed project; additional details are included in the BA, MMPA Proposed Rule, SouthCoast's COP, and the DEIS.

The Lease Area is located on the outer continental shelf (OCS) off the coast of Massachusetts, approximately 26 nm (48 km) south of Martha's Vineyard and 20 nm (37 km) south of Nantucket. The location of the SouthCoast WFA and the ECC route are shown in Figure 3.1.

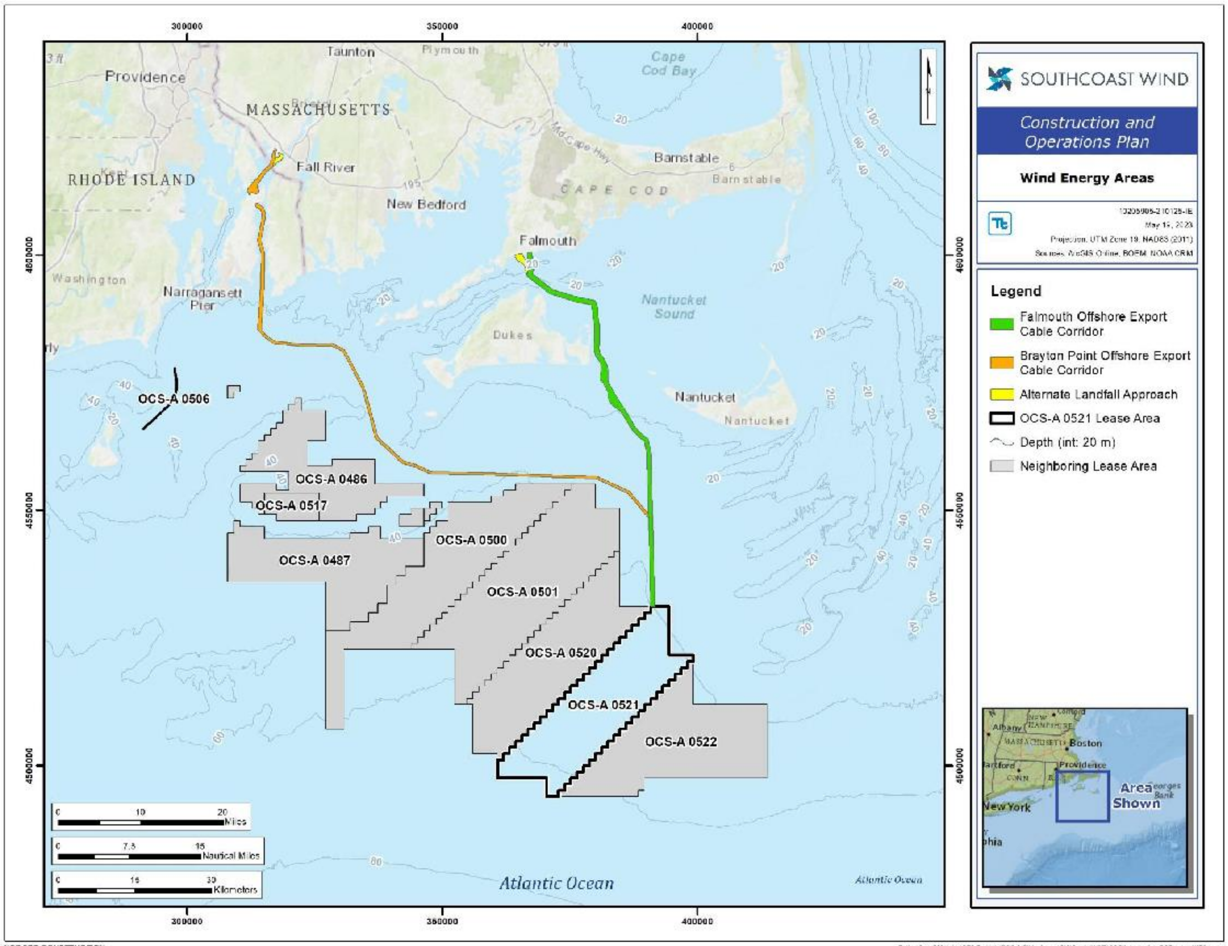

Figure 3.1: Map of the SouthCoast Wind WFA (outlined in black) and Export Cable Corridors (green to Falmouth and orange to Somerset) (Source: Figure 1-2 in COP)

The proposed action described in the BA and analyzed in this Opinion consists of two phases of development (Project 1 and Project 2) which together are the SouthCoast Offshore Wind Project (Figure 3.2). The project design envelope described (PDE) in the COP includes up to 149 WTG/OSP positions (up to 5 OSPs) installed over the two project phases. At this time, only Project 1 has an electricity offtake agreement; it is expected that approximately 1,087 MW will be provided to Massachusetts and approximately 200 MW to Rhode Island. Project 1 includes the installation of components in the northern portion of the WFA and Project 2 will be located in the southern portion of the WFA. Project 1 would include up to 85 WTGs, with the final number of WTG foundations included in Project 2 depending on the number of remaining available positions after construction of Project 1. The sum across Projects would be limited to a total of up to 147 WTG foundations for the two projects combined. The construction of Project

1 and Project 2 combined will occur over approximately a 7-year period, including onshore and offshore construction.

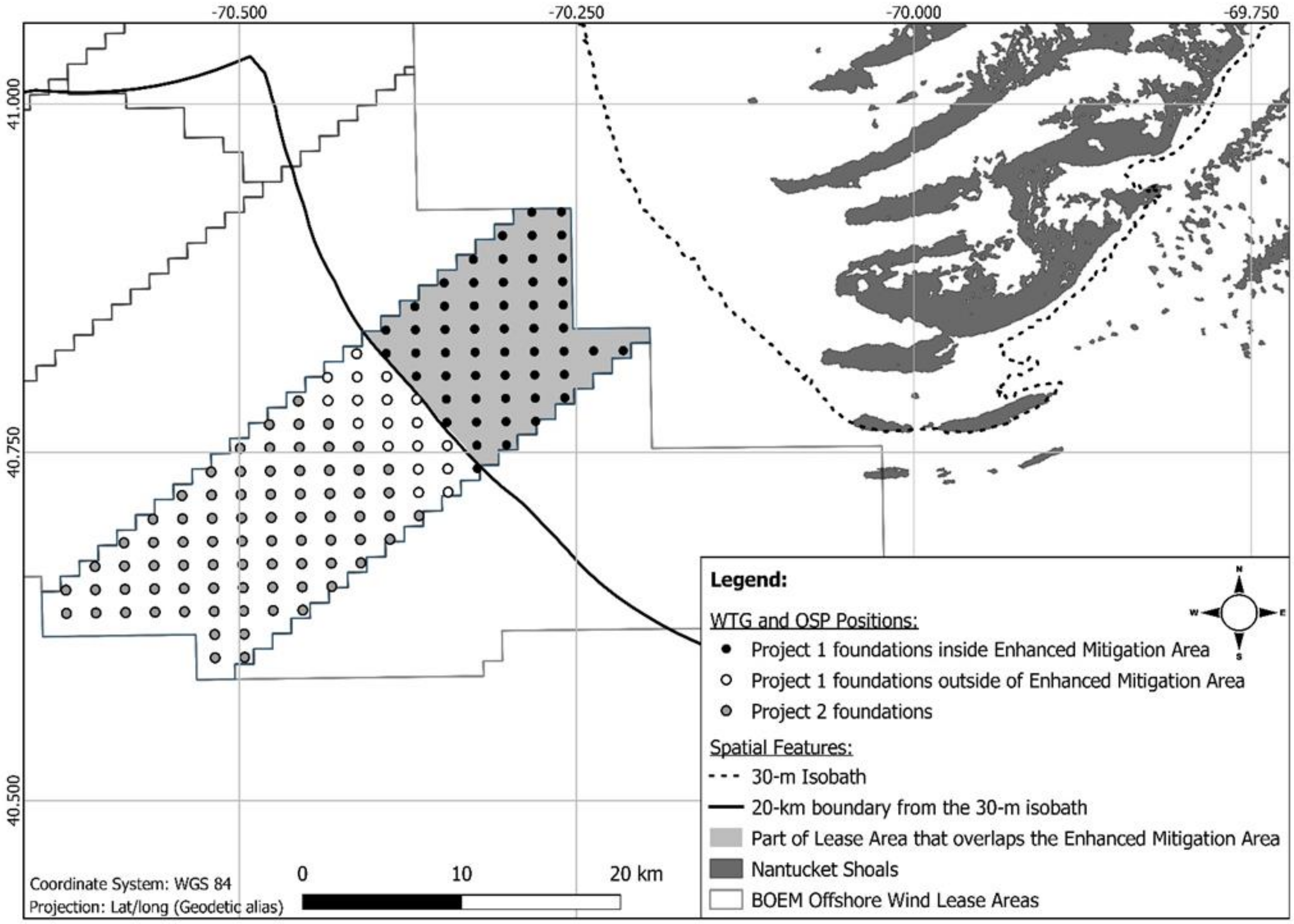

Figure 3.2 Map of Foundation Locations in the SouthCoast Lease Area, Including Project 1 (Black and White Circles), Project 2 (Gray Circles), and Inside the NARW Enhanced Mitigation Area, where additional mitigation measures are included (Black Circles). (Source: Figure 2, 89 FR 53708)

The project's export cables include offshore and inshore segments. Inter-array cables will transmit electricity from the WTGs to the OSP. Export cables would transmit electricity from each OSP to a landfall site (see Figure 3.1). SouthCoast is proposing to develop one preferred ECC for both Project 1 and Project 2, making landfall and interconnecting to the ISO New England Inc. at Brayton Point, in Somerset, Massachusetts (the Brayton Point Export Cable Corridor (Brayton Point ECC)). For Project 2, SouthCoast is proposing an alternative export cable corridor which, if utilized, would make landfall and interconnect to the ISO-NE grid in the town of Falmouth, MA (the Falmouth ECC) in the event that technical, logistical, grid interconnection, or other unforeseen challenges arise during the design and engineering phase that prevent Project 2 from making interconnection at Brayton Point. The seaward portion of both export cables are located in federal waters and state waters off the coast of Massachusetts and potentially Rhode Island. For each cable landing location (Falmouth and Somerset), a single offshore export cable route will run from each OSP to the ECC and then to the transition vault at the nearshore landing location. From the landfall sites, the underground onshore export cables would be routed to a new onshore substation in Falmouth, Massachusetts, and up to two onshore converter stations in Somerset, Massachusetts. The onshore export cables would be installed within existing roadways through open cut trenches. Construction of the onshore substation and converter station and cable installation onshore of the landfalls are not expected to affect ESA-listed species under NMFS jurisdiction. Therefore, these onshore activities are not considered further.

The SouthCoast Wind project also includes a number of survey components including high-resolution geophysical surveys (HRG), and fisheries resource surveys as described in the BA. These data collection activities will occur during the pre-construction, construction, and operation and maintenance phases of the project.

3.2 Construction

As noted above, the proposed action described in the BA would consist of two construction campaigns. Offshore construction includes installation of foundations, WTGs, OSPs, and inter-array and export cables. Prior to installation of foundations and cables, site preparation activities will take place. These include clearance of unexploded ordnance/munitions and explosives of concern (UXO/MEC or generally, UXO) and seafloor preparation (boulder clearing, dredging, and pre-lay grapnel runs). The total number of construction and installation days for each project component would depend on several factors, including environmental conditions, planning, construction method, and installation logistics. At the time consultation was initiated, onshore construction for the cable landfall locations was anticipated to begin as early as 2025; the construction schedules included in both the BA and the MMPA ITA reflect that timeline and is presented below (Figure 3.3). While there may be additional shifts in the years that construction will occur, the order and duration of the various activities presented in the table below are expected as described in the table.

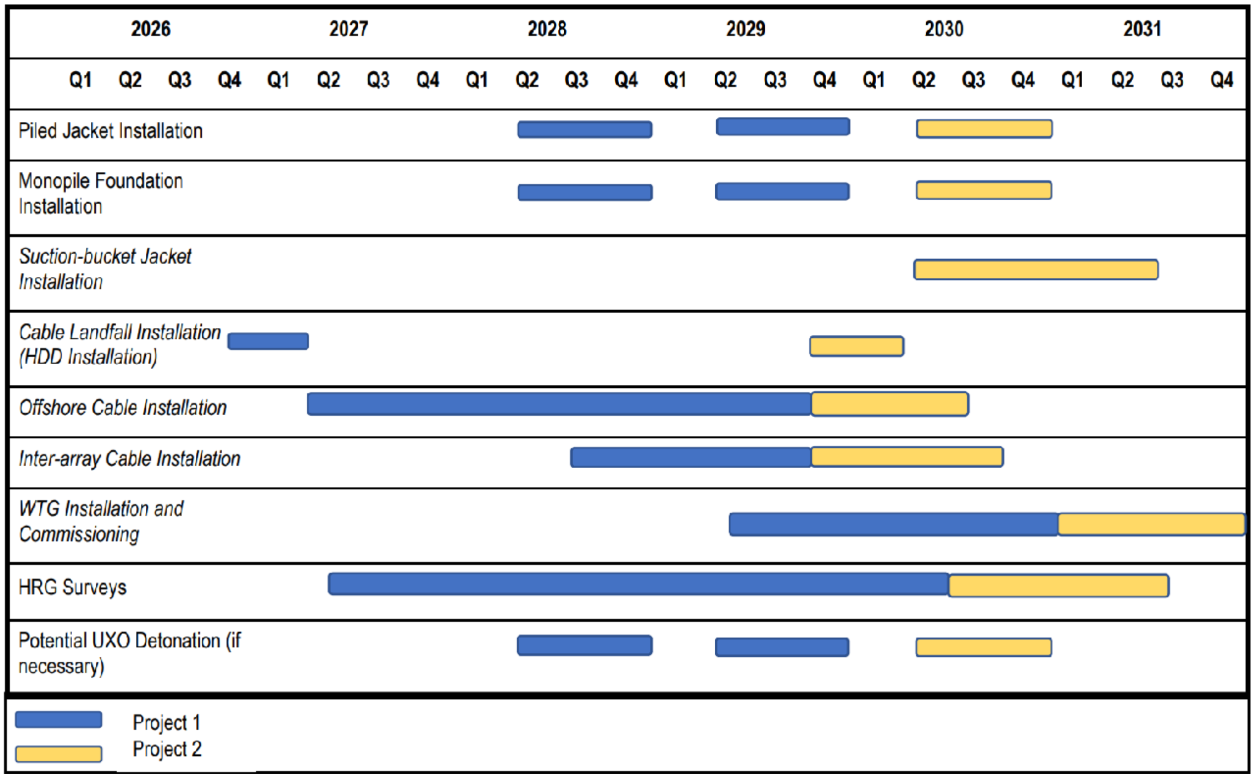

Figure 3.3: SouthCoast Wind indicative construction schedule (source: SouthCoast Wind BA Figure 3.1-3). Note: Project 1 refers to the development in the northern portion of the Lease Area and associated interconnection (Brayton Point), and Project 2 refers to the development in the southern portion of the Lease Area and associated interconnection (Brayton Point or Falmouth).

3.2.1 UXO/MEC Clearance/Detonation and Sea Floor Preparation

Prior to foundation and cable installation, sea floor preparation will occur. As described in the BA, BOEM and SouthCoast Wind have determined that UXO may be present in the lease area and export cable corridors. SouthCoast Wind will adhere to the "as low as reasonably practicable" (ALARP) standard process with avoidance of UXOs as the preferred mitigation methodology. As described in the BA, the exact number, size, and location of UXOs present in the Lease Area and ECCs are not currently known. For UXOs that are positively identified in proximity to planned activities on the seabed, several alternative strategies will be considered prior to detonating the UXO in place. These may include relocating the activity away from the UXO (avoidance), moving the UXO away from the activity (lift and shift), cutting the UXO open to apportion large ammunition or deactivate fused munitions, using shaped charges to reduce the net explosive yield of a UXO (low-order detonation), or using shaped charges to ignite the explosive materials and allow them to burn at a slow rate rather than detonate instantaneously (deflagration). Only after these alternatives are considered would a decision to detonate the UXO in place be made.

As described in the BA, to detonate a UXO, a small charge would be placed on the UXO and detonated, causing the UXO itself to then detonate. The exact number and type of UXOs in the WDA are not yet known, but SouthCoast Wind estimates that up to five UXOs in the Lease Area and up to five along the ECCs may have to be detonated in place. As such, as described in the

BA and the MMPA proposed rule, the proposed action for this consultation includes up to 10 UXO detonations. If required, UXO detonations would occur starting as soon as Quarter (Q) 2 2028 and occur periodically through Q4 2030 (with no more than one detonation per day), corresponding to the timeline for WTG/OSP foundation installation and cable installation. To avoid times when North Atlantic right whales are most likely to be present, UXO detonations would only be planned to occur from May through November for Project 1 and June through November for Project 2. In addition to these time of year restrictions, SouthCoast Wind has proposed and BOEM will require a number of mitigation measures to minimize impacts from UXO clearance and detonation (BA Table 3.3-1 and this Opinion's Appendix A). Mitigation measures for UXO detonation are also required through the proposed MMPA ITA (see Appendix B).

3.2.2 Foundation Installation – WTGs and OSPs

Foundations to support WTGs and OSPs will be installed following completion of any necessary seafloor preparation (see above). The proposed project includes the installation of up to 147 WTG foundations and up to five OSP foundations but will not exceed a total of 149 foundations. Consistent with the action considered in the MMPA ITA, Project 1 will include installation of up to 86 foundations (85 WTG, 1 OSP). Foundation installation will begin within the NARW Enhanced Mitigation Area of the Project 1 area (see Figure 3.2) no earlier than June 1, 2028. Foundation installation may begin outside the NARW Enhanced Mitigation Area starting on May 16, 2028. SouthCoast will begin foundation installation closest to Nantucket Shoals and then progress towards the southwest and moving away from Nantucket Shoals. The number of WTG foundations available for Project 2 depends on the final footprint for Project 1 so as not to exceed a total of 147. SouthCoast would install Project 2 foundations in the portion of the Lease Area southwest of Project 1 after Project 1 foundations are installed. Installation of Project 1 foundations are planned for a single construction season but may extend to a second construction season if there are delays related to weather, equipment availability, supply chain, etc. Foundation installation across both projects may occur over up to three calendar years.

Consistent with the action considered in the MMPA ITA, for Project 1 all WTGs will be installed on either all monopile or all jacket foundations, with installation by impact hammer only (i.e., no vibratory pile setting). For Project 2, WTG foundations will be installed on monopiles or jacket foundations, via impact hammer only or vibratory hammer followed by impact hammer. Suction-bucket jacket foundations are also under consideration for Project 2 WTG foundations.

Monopiles consist of a single vertical, hollow steel pile connected to a transition piece, which attaches the WTG tower or OSP topside to the monopile above the water line. The monopile foundations would have a maximum diameter of 16-meters and be installed to a maximum depth of 70 meters. As described in the BA, jacket structures are large lattice structures fabricated of steel tubes welded together. Jackets will consist of three- or four-legged structures to support WTGs and four- to six-legged structures to support OSPs. Each leg will be anchored by one pile foundation per monopile/leg for WTGs and up to four pile foundations per leg for OSPs (with multiple legs possible, depending on OSP design). Pin piles will have a diameter of up to 4.5 meters.

The impact hammer utilized for installation of monopile foundations would be deployed on a jack-up or heavy lift vessel using dynamic positioning or anchoring and have a maximum rated capacity of 6,600 kilojoules. Up to two monopiles could be installed per day. The impact hammer utilized for installation of pin piles for piled jacket foundations would have a maximum rated capacity of 3,500 kilojoules. Up to four pin piles would be driven per day. It is possible that suction bucket foundations, which do not require pile driving, could be used for foundations in Project 2; therefore, this foundation type is considered as part of the proposed action for Project 2 only (see below).

As described in the MMPA Proposed Rule, a typical impact pile driven monopile installation sequence begins with transport of the monopiles either directly to the Lease Area or to the construction staging port by an installation vessel or a feeding barge. At the foundation location, the main installation vessel upends the monopile in a vertical position in the pile gripper mounted on the side of the vessel. The impact hammer is then lifted on top of the pile and pile driving commences with soft-start procedures (as described in the MMPA Proposed Rule these would involve operating at reduced hammer energy for at least 20 minutes), where lower hammer energy is used at the beginning of each pile installation to allow marine mammal and prey to move away from the sound source before noise levels increase to the maximum extent. Piles are driven until the target embedment depth is met, then the pile hammer is removed and the monopile is released from the pile gripper. SouthCoast would install WTG monopiles using an impact pile driver with a maximum hammer energy of 6,600 kJ (model NNN 6600 or similar) for a total of 7,000 strikes (including soft-start hammer strikes) at a rate of 30 strikes per minute to a total maximum penetration depth of 50 m (164 ft.). For pile installations utilizing vibratory pile driving as well (Project 2 WTGs only), this impact installation sequence would be preceded by use of a vibratory hammer to drive the pile to a depth that is sufficient to fully support the structure before beginning the soft-start and subsequent impact hammering. For these piles, SouthCoast would use a vibratory hammer (model HX-CV640 or similar) followed by a maximum of 5,000 impact hammer strikes (including soft-start) using the same hammer and parameters specified above.

As described in the MMPA Proposed Rule, any WTG jacket foundations are expected to be pre-piled, meaning that pin piles would be installed first, and the jacket structure would be set on those pre-installed piles. Once the piled-jacket foundation materials are delivered to the Lease Area, a reusable template would be placed on the prepared seabed to ensure accurate positioning of the pin piles that will be installed to support the jacket. Pin piles would be individually lowered into the template and driven to the target penetration depth using the same approach described for monopile installation. For installations requiring only impact pile driving, SouthCoast would install pin piles using an impact pile driver with a maximum hammer energy of 3,500 kJ (MHU 3500S or similar) for a total of 4,000 strikes (including soft-start hammer strikes) at a rate of 30 strikes per minute to a maximum penetration depth of 70 m (229.6 ft.). When installations require both types of pile driving, this impact pile driving sequence would only begin after SouthCoast utilized a vibratory hammer (S-CV640 or similar) to set the pile to a depth providing adequate stability. Subsequent impact hammering (using the same hammer specified above) would require fewer strikes (n=2,667) to drive the pile to the final 70-m maximum penetration depth.

Additional information on the planned pile driving is included in the MMPA Proposed Rule and in Section 7.1 *Effects of the Action* in this Opinion. No foundation pile driving would occur from January 1-May 15 of any year anywhere in the lease area, and no foundation pile driving would occur from October 16 – May 31 within the identified "North Atlantic Right Whale Enhanced Mitigation Area" (see Figure 2 in 89 FR 53708 and Figure 3.2 above). A number of other mitigation measures for pile driving are proposed by SouthCoast and will be required by BOEM and/or OPR (see Appendix A and B of this Opinion). The pile driving schedule (up to 2 monopiles per day and up to 4 pin piles per day) is based on a planned 24-hour construction period. Both the BA and proposed MMPA ITA describe the conditions that SouthCoast would need to meet in order for pile driving to be initiated at night. Absent an approved night time monitoring plan, consistent with the description of the action in the proposed MMPA ITA, all pile driving will be initiated during day time (i.e., between one hour after civil sunrise to 1.5 hours before civil sunset), and nighttime pile driving could only occur if unforeseen circumstances (e.g., temporary shutdowns caused by marine mammal or sea turtle sightings, weather or metocean conditions, or equipment repair/maintenance or slower-than-anticipated pile driving speeds caused by geotechnical or other factors) prevent the completion of pile driving during daylight hours and it is necessary to continue piling during the night to protect the asset integrity or safety. Additional information on the requirements for nighttime pile driving is provided in Section 7.1 *Effects of the Action*. The only "concurrent" (i.e., potential for two piles to be installed at the same time) pile driving that is part of the proposed action is limited to the up to four days per project when a WTG and OSP foundation may be driven at the same time.

Wind Turbine Generators
The WTGs would consist of three components: a three-bladed rotor nacelle assembly, the tower, and the foundation. The nacelle contains the vital components of the WTG including the generator, transformers, converter, and additional subsystems necessary to generate electricity and control WTG functionality. The nacelle would be positioned on a multi-sectional tower attached to a transition piece or foundation depending on the foundation design selected. As required by 30 CFR § 285.705, the certified verification agent (CVA) will review and verify that all WTG design standards are met and are compatible with site-specific conditions. The WTGs will be designed to operate within a certified set of loading scenarios and withstand a certified set of climatic conditions.

Each WTG would extend up to 1,066 ft. (325 m) above mean lower low water (MLLW) and spacing between WTGs would be installed in a uniform east-to-west, north-to-south grid pattern with 1-nautical-mile (1.9-kilometer, 1.15-mile) by 1-nautical-mile (1.9-kilometer, 1.15-mile) spacing between positions.

Offshore Substation Platforms
As described in the BA, the Project would include up to five OSPs. Three OSP designs are under consideration: Option A –Modular, Option B – Integrated, Option C – high voltage direct current (HVDC) Converter. As noted in the MMPA Proposed Rule, SouthCoast currently identifies installation of one DC-converter OSP per project, each supported by a piled jacket foundation, as the most realistic scenario. SouthCoast has already selected an HVDC Converter OSP (Option C) for Project 1. For Project 2, SouthCoast will select an OSP design based on future offtake agreements and through its supplier/equipment contracting process. If HVDC is

selected for Project 2, which is the most likely scenario, there would be one HVDC OSP for Project 2 in addition to the HVDC OSP for Project 1 (for a total of two HVDC OSPs). Alternatively, if HVAC is selected for Project 2, SouthCoast Wind anticipates there would be one HVAC OSP for Project 2 in addition to the HVDC OSP for Project 1 (for a total of two OSPs).

Each OSP design would include a topside that houses electrical equipment and a foundation substructure to support the topside. The smallest topside structure would be Option A – Modular and would likely hold a single alternating current (AC) transformer with a single export cable. It would sit on any type of substructure design considered for the WTGs (monopile, piled jacket, or suction-bucket jacket). Option B – Integrated is also an AC solution but is designed to support a high number of inter-array cable connections, as well as multiple export cable connections and would contain multiple transformers in a single topside structure. Depending on the weight of the topside structure and soil conditions, the jacket substructure may be four- or six-legged and require one to three piles per leg. Because of its larger size, if Option B is selected, a smaller number of OSPs would be required to support the proposed Project. Option C – HVDC Converter would convert electric power from high voltage alternating current (HVAC) to HVDC for transmission to the onshore grid system and would serve as a gathering platform for inter-array cables or be connected to one or more HVAC gathering units, which would be similar to the Modular and Integrated OSP designs. Due to its size, the HVDC Converter OSP would be installed on piled jacket foundation.

OSPs will be installed on monopile or jacketed foundations, with jacketed foundations identified as the most likely scenario. The number of jacket legs and pin piles would be dependent on the OSP design. All OSP foundations will be installed with an impact hammer. Installation of an OSP monopile foundation would follow the same parameters (e.g., pile diameter, hammer energy, penetration depth) and procedure as described for WTG monopiles. OSP piled jacket foundations would be similar to that described above for WTG piled jacket foundations but would be installed using a post-piling, rather than pre-piling, installation sequence. In this sequence, the seabed is prepared, the jacket is set on the seafloor, and the piles are driven through the jacket legs to the designed penetration depth (dependent upon which OSP design is selected). The piles are connected to the jacket via grouted and/or swaged connections. A second vessel may perform grouting tasks, freeing the installation vessel to continue jacket installation at a subsequent OSP location, if needed. Pin piles for each jacket design would be installed using an impact hammer with a maximum energy of 3,500 kJ. A maximum of four OSP pin piles could be installed per day using a single vessel, assuming 24-hour pile driving operations. As described in the MMPA Proposed Rule, all impact pile driving activity of pin piles would include a 20-minute soft-start at the beginning of each pile installation, with each pin expected to take up to 2 hours of impact hammering.

Suction Bucket Foundation Installation
As an alternative to pile driven foundations, suction bucket foundations may be included for Project 2. As described in the BA, suction-bucket jackets would have a similar steel lattice design to the piled jacket but use suction-bucket foundations instead of piles to secure the structure to the seabed. During installation of suction-bucket jacket substructures, the jacket is lowered to the seabed, and the open bottom of the bucket and weight of the jacket embeds the bottom of the bucket in the seabed. To complete the installation and secure the foundation, water

and air are pumped out of the bucket at an approximate rate of 300 to 500 cubic meters per hour creating negative pressure within the bucket of approximately five bar, which embeds the foundation buckets into the seabed. The jacket can also be leveled at this stage by varying the applied pressure. The pumps will then be released from the suction buckets once the jacket reaches its designed penetration depth of 65.6 feet (20 meters). The connection of the required suction hoses is typically completed using a remotely operated vehicle (ROV). A typical duration for suction bucket jacket installation is 15 to 20 hours per foundation. Pump parameters (such as flow rate) depend on the final design of the suction bucket foundation. However, the flow rate will be designed so that seabed disturbance is avoided. Each bucket would have a diameter of up to 65.6 feet (20 meters) and a maximum volume of up to ~8,894 cubic yards (6,800 cubic meters).

Scour Protection for WTG and OSP Foundations
Scour protection would be installed around WTG and OSP foundations to prevent scouring of the seabed around the foundations. The type and amount of scour protection utilized will vary based on a variety of factors, including foundation type, water flow, and substrate type. The scour protection types proposed are rocks, rock bags, concrete mattresses, sandbags, artificial seaweed/reefs/frond mats, or self-deploying umbrella systems. Installation activities and order of events of scour protection would largely depend on the type and material used. In the case of rock scour protection, a rock placement vessel may be deployed. A thin layer of filter stones is typically placed before driving the piles, while the armor rock layer is typically installed after pile installation. Final scour protection strategy and installation will be refined during detailed design. Frond mats or umbrella-based structures may be pre-attached to the substructure, so are therefore simultaneously installed. Maximum seabed disturbance parameters, including scour protection, for 147 WTGs and 2 OSPs (includes OSPs with largest seabed footprint) are presented in Table 3.1.

Table 3.1. Summary of scour protection dimensions for the different foundations being considered (from BA Table 3.1-9).

Maximum Scour Protection per Foundation	Permanent Footprint per Foundation	Scour Protection Volume per Foundation	Additional Temporary Disturbance from Seafloor prep per Foundation
Monopile (WTG)	2.5 acres	36,256 cubic yards	0.5 acres
Piled jacket (WTG)	2.6 acres	37,635 cubic yards	0.5 acres
Suction bucket jacket (WTG)	4.9 acres	75,583 cubic yards	0.6 acres
Piled Jacket (OSP)	9.8 acres (per OSP)	157,193 cubic yards (per OSP)	0.5 acres (per OSP)

3.2.3 Cable Installation
The proposed project includes two cable networks: the IAC, which would carry electrical current produced by the WTGs to the OSPs, and the ECC that would carry electrical current from each

OSPs to the landfall sites in Falmouth and Brayton Point. Installation of the two cable networks will require hydraulic plow (i.e., jet-plow and mechanical plow) or similar technology for displacing sediments to allow for cable burial. SouthCoast Wind is proposing to lay most of the inter-array cable and offshore export cable using simultaneous lay and bury via jet embedment. The final cable burial method(s) would be selected based on seabed conditions, the required burial depths, and pre-installation cable burial surveys and studies. More than one installation and burial method may be selected per route and has the potential to be used pre-installation, during installation, and/or post-installation. Suction hopper dredging or water injection dredging may be needed in up to 5 percent of the cable route for seabed preparation to allow for cable installation through areas with sand waves. The final cable burial method(s) would be selected based on seabed conditions, the required burial depths, and pre-installation cable burial surveys and studies, but would utilize one of a combination of vertical injectors, jetting sleds, jetting ROVs, pre-cut plows, mechanical plows, and mechanical cutting ROVs. Target cable burial can be directly verified during installation of jetting type tools that are suitable for simultaneous laying and burial of the cables. The offshore export cables will be buried to a target depth of 3.2 to 13.1 feet (1 to 4 meters) below the seafloor within a 3,280 ft. (1,000 m) wide cable corridor to Falmouth and a 2,300 ft. (700 m) wide cable corridor to Brayton Point.

The inter-array cabling system connects the WTGs to the OSPs through a series of submarine cables. Inter-array cables are arranged in strings and connect multiple WTGs to the OSP. The nominal interarray cable voltage is between 60 kV and 72.5 kV. The final layout of the inter-array cables will be determined at a later date based on site characterization data, selected WTGs, cable capacity, and installation and operating conditions. A pre-lay grapnel run would be completed along the entire length of each interarray cable route within the Lease Area shortly before cable installation to clear the cable route of buried hazards along the installation route to remove obstacles that could impact cable installation, such as abandoned mooring lines, wires, or derelict fishing gear. Target burial depths of the IAC is 6 ft. (1.8 m) with a minimum of 3.2 ft. (1.0 m) and a maximum depth of 8.2 ft. (2.5 m).

The IAC would include multiple segments that extend from 124.3 mi to 497.1 mi (200 km to 800 km), connecting up to 9 WTGs per string to one of the OSPs. The total area of temporary disturbance estimated during installation of the IAC is 1,408 acres, while the total permanent footprint of anticipated cable protection during both phases is 122 acres (SouthCoast Wind COP Volume 1, 2023).

The Project will include up to two offshore export cable corridors; the Falmouth export cable corridor and the Brayton Point export cable corridor. Within the Falmouth export cable corridor, up to five offshore export cables, including up to four power cables and up to one dedicated communications cable, will connect the OSPs to the landfall site in Falmouth. For transmission of the proposed Project’s power to shore within the Falmouth export cable corridor, a nominal voltage between 200 and 345 kV has been identified as most suitable for SouthCoast Wind. Within the Brayton Point export cable corridor, up to six offshore export cables, including up to four power cables and up to two dedicated communications cables, will connect the OSPs to the landfall site at Brayton Point. For transmission within the Brayton Point export cable corridor, a nominal voltage of ±320 kV has been identified as most suitable for SouthCoast Wind. The SouthCoast ECC would transfer electricity from the OSPs to the Onshore Export Cable, the portion of the export cable from the landfall site that connects to the onshore substation. The Offshore and Onshore Export Cables will be connected using transition vaults. The SouthCoast corridor would be located in both federal and Massachusetts and Rhode Island State waters (see Figure 3.1).

Burial of the SouthCoast Export Cable would be a target of 6 ft. (1.8 m) below sea floor, with a minimum of 3.2 ft. (1.0 m) and a maximum of 13.1 ft. (4.0 m) for both routes. Burial depth will depend on an assessment of sea floor conditions, sea floor mobility, and risk of interaction with external hazards such as fishing gear and vessel anchors, and a Cable Burial Risk Assessment. SouthCoast Wind intends to maintain an export cable corridor width of between 2,625 ft. (800 m) and 3,280 ft. (1,000 m) for the Falmouth export cable corridor, and between 1,640 ft. (500 m) to 2,300 ft. (700 m) for the Brayton Point export cable corridor, to allow for maneuverability during installation and maintenance. The offshore export cable corridors may be locally narrower or wider to accommodate sensitive locations and to provide sufficient area at landfall locations, at crossing locations, or for anchoring. The total area of disturbance for the Falmouth Export Cable will be 1,753 acres with a potential of 493,962 m^3 dredge material. The total area of disturbance for the Brayton Point Export Cable will be 727 acres with a potential 17,124 m^3 of dredge material.

For all portions of the OEC and IAC, when burial cannot occur, or depth not achieved, or where cable crosses other cables/pipelines, additional cable protection methods may be used (e.g., rock berms/bags, concrete mattresses). One or more of the following cable protection solutions may be used for secondary cable protection:

- Prefabricated concrete mattresses, consisting of several concrete block sections connected by polypropylene;
- Frond mattresses specifically designed to promote sedimentation and mitigate scour; Rock installation by means of a shaped berm profile or rock bags;
- Cable Protection Systems (CPS), typical example comprising two cylindrical half-shells of polyurethane or similar material, which overlap and interlock to form close-fitting protection around the cables;
- Grout or sand bags, which can be installed by divers or Remotely Operated Vehicles (ROVs) to stabilize or fix in place cables over short distances.

Sea-to-Shore Connection

There are three potential sea-to-shore transition locations in Falmouth, Massachusetts and two potential locations in Brayton Point in Somerset, Massachusetts. The landfall locations in Falmouth, Massachusetts include Worcester Avenue, Central Park, and Shore Street. The landfall locations at Brayton Point in Somerset, Massachusetts include the Western landfall location from the Lee River and the Eastern landfall location from the Taunton River. Additionally, the Brayton Point offshore export cables will make intermediate landfall on Aquidneck Island in Portsmouth, Rhode Island, in order to avoid a narrow and highly constrained area of the Sakonnet River at the old Stone Bridge and Sakonnet River Bridge, representing a significant challenge to survey, cable installation, burial, and operation. This landfall will require Horizontal Directional Drilling (HDD) at two locations, one entering and one exiting Aquidneck Island. One landfall location is under consideration for entering

Aquidneck Island, and four locations among three route options are under considering for existing Aquidneck Island.

The SouthCoast export cable would transition from offshore to onshore using HDD. HDD would involve drilling underneath the sea floor using a drilling rig positioned onshore in the landfall envelope; the maximum design envelope for the HDD methodology includes boring one hole for each offshore export cable. HDD seaward exit points would be within 3,500 feet (1,069 meters) of the shoreline for the Falmouth ECC landfall, and within 1,000 feet (305 meters) of the shoreline for the Brayton Point landfalls. At the seaward exit point, construction activities may include either a temporary gravity-based structure (i.e., gravity cell or gravity-based cofferdam) and/or a dredged exit pit. Installation of both the temporary gravity-based structure and/or a dredged exit pit would not require pile driving or hammering. Additionally, a conductor pipe made of high-density polyethylene or similar material may be installed at the exit point to support the drill activity. Mechanical dredging may also be considered for use in excavation activities nearshore, at HDD exit pits, which will be in shallower waters depths (< 10 meters). Seabed disturbances from HDD exit pits for landfall locations are shown in Table 3.2.

Table 3.2: Area of disturbance at HDD exit pits for landfall locations

Sea-to-Shore HDD	**Area Disturbed, Acre (Hectare)**
Falmouth	
Exit Pit/cofferdam (per HDD)	0.10 (0.04)
Total Area Disturbed (4 HDDs)	0.40 (0.16)
Brayton Point/Aquidneck Island	
Exit Pit/cofferdam (per HDD)	0.30 (0.12)
Total Area Disturbed (12 HDDs)	3.6 (1.45)

Source: SouthCoast BA Table 3.1-13.

3.3 Operations and Maintenance

Operations and maintenance (O&M) activities are described in the BA and the COP and summarized here. O&M will occur over the 35 year operating duration of the SouthCoast Wind Project. As described by BOEM, the proposed Project includes a comprehensive maintenance program, including preventative maintenance based on statutory requirements, original equipment manufacturers' guidelines, and industry best practices. SouthCoast would inspect WTGs, OSPs, foundations, interarray cables, submarine and onshore export cables, and other parts of the proposed Projects using methods appropriate for the location and element. Additionally, SouthCoast would maintain an Oil Spill Response Plan (OSRP), an Incident Management Plan, and a Safety Management System. These plans would be in place before construction and installation activities begin and would be reviewed and approved by BOEM and the Bureau of Safety and Environmental Enforcement (BSEE). Information on vessel use for this phase is described in Section 3.6 *Description of the Proposed Action*; SouthCoast plans to use one SOV and two CTVs to support routine inspection, operations, and maintenance activities. CTVs would be used to transfer crew and small parts to and from, and also within the Lease Area. Additional vessels, helicopters, and drones could be used for urgent personnel transfer, part delivery, cable, or substructure and WTG inspections or other planned or unplanned maintenance as described in Section 3.6.

Planned maintenance activities for the WTGs include planned minor and major maintenance activities including inspecting components and equipment for replacement in accordance with the WTG supplier's specified maintenance schedule. Statutory inspections of WTGs' safety and electrical equipment would occur in conformance with all applicable regulations. Unplanned maintenance activities may also occur in response to instances outside scheduled service, such as unplanned outages or equipment failures. This may require the use of a jack-up vessel or transportation vessel to carry, install, and/or repair the failed component(s). To minimize the need for unscheduled maintenance, the WTGs will include remote monitoring and analytics to track component condition and wear. Major scheduled repairs will be planned in yearly campaigns. Internal and external inspections of foundations will occur every 2 years to ensure structural integrity. ROVs or Autonomous Underwater Vehicles (AUVs) will be deployed for general underwater visual inspections that will include detection of corrosion, damage to the substructure, cracks at welds, excessive marine growth, and seabed scour.

All structures will be equipped with lighting as required by the USCG, FAA, and/or relevant regulatory body and abide by all applicable standards. This includes lighting on all offshore structures that will be visible throughout a 360-degree arc to aid in mariner navigation. SouthCoast Wind will implement an Aircraft Detection Lighting System (ADLS), which will activate the lighting system on WTGs based on approaching air traffic. SouthCoast Wind does not anticipate utilizing continuous lighting on the WTGs at the water's surface; however, SouthCoast Wind does plan to illuminate, at a minimum, the landing during crew transfers (specifically, the Walk to Work gate). The gangway from operations vessels will be fitted with necessary lighting that meets minimum requirements to assure safe transfers of technicians.

The OSPs have been designed as normally unmanned installations. During operation, the OSPs would be remotely monitored from an onshore facility through supervisory control and data acquisition systems, which acts as an interface for a number of sensors and controls throughout the Lease Area that will allow for the remote monitoring and operation of the OSP on a 24 hour per day, 365 days per year basis. The remote monitoring, diagnostic, and operating systems will be employed to proactively identify onboard equipment failures and for support of unplanned maintenance activities. Even with remote monitoring systems in place, unplanned maintenance can occur that may involve repair or replacement of project infrastructure. Most maintenance activities will be minor in nature and will not require heavy construction equipment. On occasion, major maintenance activities may need to occur that may require a jack-up vessel or transportation vessel on site. O&M technicians would visit the OSPs routinely for equipment inspections and to perform planned and unplanned maintenance activities.

A summary of the WTG and OSP maintenance activities and the maximum frequency at which they are anticipated to occur is provided in Table 3.3, below.

Table 3.3. Indicative WTG and OSP Maintenance Activities.

O&M Task (WTGs)	Inspection Cycle
Planned Annual Maintenance	Annual
Routine Maintenance and Regulatory Inspection (including lifesaving equipment)	Annual

Blade Inspections (may be inspected by drone)	Every 1 to 3 years
Hydraulic Oil Change per WTG (on average)	Every 10 years
Gear Oil Change Per WTG (not applicable to direct drive	Every 6-10 years
Unplanned Maintenance	As needed
Approximate Visits for Unscheduled Maintenance	Annually
O&M Task (OSPs)	**Inspection Cycle**
Routine Inspections	As Required Based on Final OSP Design
Maintenance of Switchgear and Equipment	Annually
Transformer Oil Sample and Targeted Maintenance	Every 3 years
Extended Maintenance Routines	Every 5 and 10 years
Unplanned Maintenance	As needed

Source: SouthCoast Wind BA (Tables 3.1-4 and 3.1-6)

Each WTG and OSP would require various oils, fuels, and lubricants to support operations. Sulfur hexafluoride (SF_6) would also be used for insulation purposes. Table 3.4 provides a summary of the maximum quantities of these materials potentially required for each WTG. The spill containment strategy for each WTG and OSP comprises similar preventive, detective, and containment measures. These measures include 100 percent leakage-free joints to prevent leaks at the connectors; high pressure and oil level sensors that can detect both water and oil leakage; and integrated retention reservoirs capable of containing 110 percent of the volume of potential leakages at each WTG. Additionally, WTG switchgear containing SF_6 will be equipped with integral low-pressure detectors to detect SF_6 gas leakages should they occur.

Table 3.4. Summary of the Maximum Potential Quantities of Oils, Fuels, Lubricants per WTG and OSP.

WTG System/Component	**Material**	**Maximum Quantity per WTG**
WTG Bearings and Yaw Pinyons	Grease	150 gallons (570 liters)
WTG Hydraulic Pumping Unit, Hydraulic Pitch Actuators, Hydraulic Pitch Accumulators, Mechanical Brake	Hydraulic Oil	200 gallons (750 liters)
Drive Train Gearbox, Yaw Drives Gearbox	Gear Oil	600 gallons (2,500 liters)
WTG Transformer	Transformer Silicon/Ester Oil	2,000 gallons (7,500 liters)
WTG Auxiliary Power Generators	Diesel Fuel	900 gallons (3,500 liters)
WTG Tower Damper and Cooling System	Glycol/Coolants	500 gallons (2,000 liters)
OSP Generator	Diesel Fuel	40,000 gallons (150,000 liters)
OSP Generator	Lubricant	450 gallons (11,688 liters)
OSP Generator	Cooling water (with 30% glycol)	300 gallons (1,150 liters)

OSP – HVAC System	Refrigerant	300 lbs. (135 kg)
OSP – HVAC System	Polyester oil	50 gallons (190 liters)
OSP – Crane	Hydraulic oil	500 gallons (190 liters)
OSP – Transformer oil	Dielectric insulating oil	150,000 gallons (570,000 liters)
OSP – Electrical coating	Epoxy coating	5 gallons (20 liters)
OSP – Fire extinguishing agents	Foam for firefighting system	4,000 (15,000 liters) (water/foam concentrate)
OSP Generator	Urea	2,000 gallons (7,500 liters)
OSP – HVAC System	Propylene Glycol	4.5 m^3
OSP – Cooling System	30% Propylene Glycol/Water	40 m^3
OSP – Cooling System	Sodium Hypochlorite	5 m^3
OSP Batteries – General UPS	Sulphuric Acid	30 Ton
Batteries for Navigation light System UPS	Sulphuric Acid	264 kg
Gas insulated equipment	SF_6	10 Ton
Gas insulated equipment	SF_6	6.5 Ton
Cooling medium system	Cooling water (with 30% glycol)	50 m^3

Source: SouthCoast Wind COP (Table 3-26)

The interarray and export cables are buried and not expected to require regular maintenance, except for manufacturer-recommended cable testing. Periodic visual inspections of the interarray cables would be planned based on survey data and manufacturer recommendations based on the as-built drawings. Burial inspection visuals would occur periodically to be determined after final design. Episodic repairs of cable faults, failures, and exposed cables would be conducted as necessary. These repairs would require the use of various cable installation equipment, similar to the ones described for construction activities.

3.4 Decommissioning

The SouthCoast Wind Project would be decommissioned and removed at the end of its approximately 35-year operating period. Consistent with the requirements of 30 CFR 585 and their lease, SouthCoast Wind would be required to remove or decommission all facilities, projects, cables, pipelines, and obstructions and clear the sea floor of all obstructions created by the proposed Project. Unless otherwise authorized by BSEE, pursuant to the applicable regulations in 30 CFR Part 285, SouthCoast Wind would be required to "remove or decommission all facilities, projects, cables, pipelines, and obstructions and clear the seafloor of all obstructions created by activities on leased area, including any project easement(s) within two years following lease termination, whether by expiration, cancellation, contraction, or relinquishment, in accordance with any approved SAP, COP, or approved Decommissioning Application and applicable regulations in 30 CFR Part 285." BOEM may authorize facilities to remain in place. When possible, decommissioning would recover valuable recyclable materials, including steel foundation components.

In accordance with BSEE requirements, SouthCoast Wind would be required to remove and/or decommission all project infrastructure and clear the seabed of all obstructions when the Project reaches the end of its 35-year operational period. Before ceasing operation of individual WTGs or the entire Project and prior to decommissioning and removing Project components, SouthCoast Wind would consult with BSEE and submit a decommissioning plan for review and approval. Upon receipt of the necessary BSEE approval and any other required permits, SouthCoast would implement the decommissioning plan to remove, and recycle, when possible, equipment and associated materials.

For both WTGs and OSPs, decommissioning would be a "reverse installation" process, with turbine components or the OSPs topside structure removed prior to foundation removal. The blades, rotor, nacelle, and tower would be sequentially disassembled and transported to port for processing using vessels and cranes similar to those used during construction. The OSPs are expected to be disassembled in a similar manner as the WTGs, using similar vessels. Prior to dismantling, the OSP(s) would be properly drained of all oils, lubricating fluids, and transformer oil. Cables will be removed, in accordance with BSEE regulations (30 CFR 285, Subpart I). A material barge would transport components to a recycling yard where the components would be disassembled and prepared for reuse and/or recycling for scrap metal and other materials.

The foundations will be cut by an internal abrasive water jet-cutting tool (or similar equipment) at 15 feet BML and returned to shore for recycling in the same manner described for the WTG components and the OSPs. The offshore cables could be retired in place or removed, subject to authorization by BOEM and/or BSEE and any other necessary approvals. Without an authorization to retire in place, SouthCoast Wind will be required to completely remove all transmission cables from the sediment to the extent practicable and remove all associated cable protection from the sea floor. Any cable segments that cannot be fully extracted would be cut off using a cable saw and buried at least 4 to 6 feet BML. All remaining components would be completely removed from the environment and collected for recycling of valuable metals and other materials. SouthCoast Wind will clear the area after all components have been decommissioned to ensure that no unauthorized debris remains on the sea floor. Onshore decommissioning requirements will be subject to state/local authorizations and permits. Project components will be decommissioned using a similar suite of vessels as Project construction.

3.5 Surveys and Monitoring

SouthCoast Wind is proposing to carry out or BOEM is proposing to require that SouthCoast Wind carry out as conditions of COP approval, high-resolution geophysical (HRG) surveys and a number of ecological surveys/monitoring activities. These activities are described in the BA and are part of the proposed action that BOEM has requested consultation and their effects on ESA-listed species are thus evaluated in this Opinion.

3.5.1 High-Resolution Geophysical Surveys

As described in the BA, HRG surveys would occur intermittently throughout the construction, O&M, and decommissioning phases of the project. Prior to construction, one or more pre-installation surveys of the cable routes will be conducted. This survey will utilize sonar, sub-bottom profilers, echo-sounder, and/or magnetometer equipment to create images and collect data on features present on the seafloor and within the subsurface. These surveys will further inform installation and protection methods to be applied to the cables, aid in avoiding potential seafloor and subsurface hazards, and identify any anomalies or changes from prior surveys. HRG surveys will be conducted intermittently during the construction period to identify any seabed debris and provide general construction support. HRG surveys use a combination of sonar-based methods to map shallow geophysical features. The survey equipment is typically towed behind a moving survey vessel attached by an umbilical cable. Equipment may be mounted to the survey vessel or the Project may use autonomous surface vehicles to carry out this work. HRG survey vessels move slowly, with typical operational speeds of approximately 3 knots when surveying. SouthCoast Wind does not currently have any pre- or post-construction geotechnical surveys planned; however, if the specific location of certain Project components differs from the previously surveyed layout, SouthCoast Wind will perform additional geotechnical investigations at any new locations not already covered by previous investigations, as required by BOEM.

These surveys are expected to utilize active acoustic equipment; as described in the MMPA Proposed Rule, equipment such as multi-beam echosounders (MBES), sidescan sonars (SSS), shallow penetration sub-bottom profilers (SBPs) (e.g., "Chirp", parametric, and non-parametric SBPs), medium penetration sub-bottom profilers (e.g., sparkers), ultra-short baseline positioning equipment, and marine magnetometers may be used. Additional information is included in the Proposed Rule and in Section 7.1 *Effects of the Action* of this Opinion. Over the five-year duration of the proposed MMPA ITA, 75 to 113 active survey days are expected each year, covering approximately 80 km each day. A maximum of four total vessels will be used concurrently for surveying. HRG survey operations will occur on a 24-hour basis, although some vessels may only operate during daylight hours (~12-hour survey vessels). HRG surveys are anticipated to operate at any time of year for a maximum of 112.5 active sound source days. As described in the BA, following the 5-year period, SouthCoast Wind will conduct any additional G&G surveys as required by BOEM or other relevant agencies. SouthCoast Wind plans to conduct periodic cable inspection surveys, as recommended by the cable manufacturer, which could use a combination of MBES, SSS, visual, and possibly other survey technologies (i.e., synthetic aperture sonar). The exact details, including frequency, of the cable inspection surveys will be determined once a cable manufacturer is selected.

BOEM has completed a programmatic ESA consultation with NMFS for HRG surveys and other types of survey and monitoring activities supporting offshore wind energy development (NMFS 2021a; Appendix C to this Opinion). As described in the SouthCoast Wind BA, BOEM will require SouthCoast Wind to comply with all relevant programmatic survey and monitoring PDCs and BMPs included in the 2021 programmatic ESA consultation; these measures are detailed in Appendix B of the programmatic consultation). HRG surveys related to the approval of the SouthCoast Wind COP are considered part of the proposed action evaluated in this Opinion. The applicable survey and monitoring PDCs and BMPs included in the 2021 programmatic ESA consultation and identified by BOEM in its BA are also elements of the proposed action evaluated in this Opinion.

3.5.2 Fisheries and Benthic Monitoring

SouthCoast Wind is proposing to implement their Fisheries Monitoring Plan (FMP - MA; SouthCoast 2024, FMP – RI, 2023); in the BA, BOEM identified this as part of the Proposed Action for this ESA consultation. The majority of surveys will take place in federal waters in and around the lease area, but acoustic telemetry will take place along the ECC route, including in state waters. All fisheries surveys are proposed for a five-year period including two years of pre-construction monitoring, one year of monitoring during construction, and at least two years for post-construction monitoring. Surveys are proposed both within and outside the lease area (see Figure 3.4).

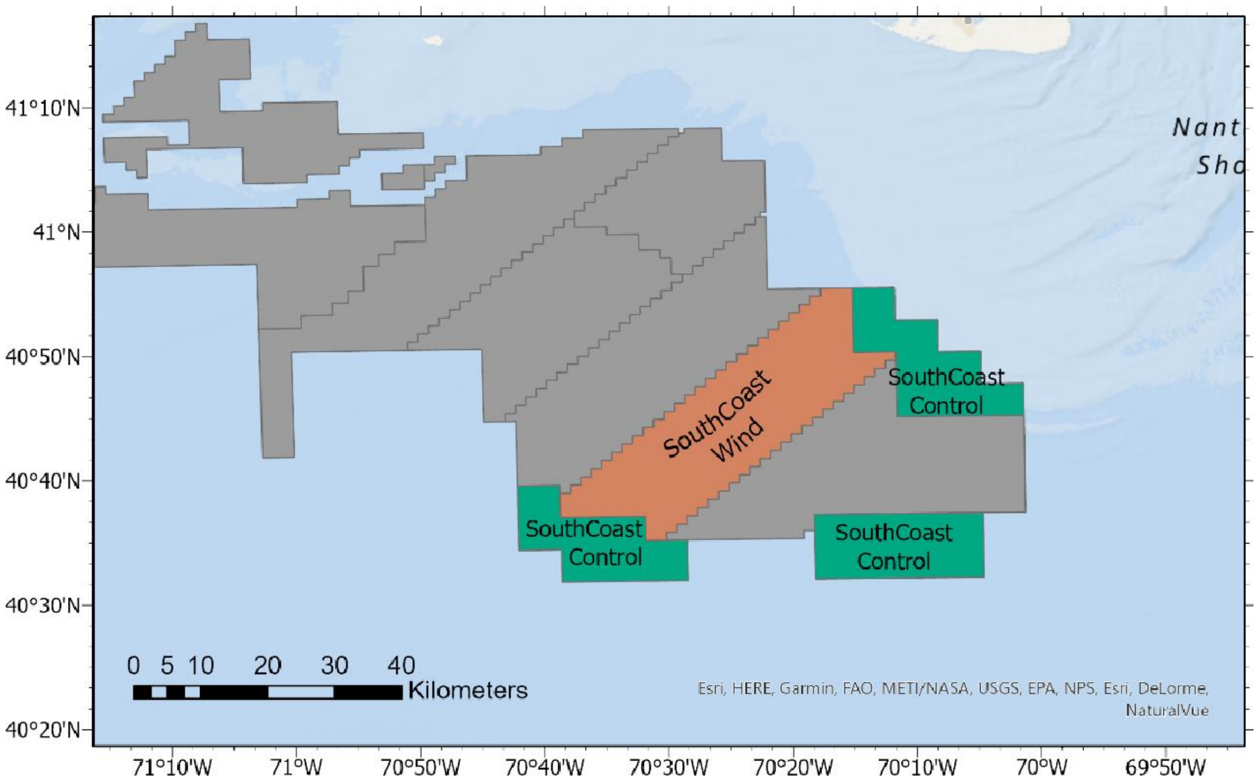

Figure 3.4: Proposed fisheries survey areas including the SouthCoast Wind Lease Area (Orange) and the control areas (green)

Ventless Trap Surveys

SouthCoast Wind will conduct a stratified random ventless lobster trap survey to sample American lobster, Jonah crab, and black sea bass in the SouthCoast Wind Lease Area and control areas from May through October over 5 years (potentially non-consecutive). The survey will sample 30 random depth-stratified stations with stations distributed throughout the development and control areas in a BACI design. Station locations will be reselected each year. For the "during" and "post construction" survey phases, any station(s) located on a turbine will be re-randomized. Trap deployment, maintenance, and hauling are expected to be contracted to commercial lobstermen, but sampling will always be conducted by an SMAST researcher onboard the fishing vessel. To the degree possible, survey gear will be hauled on a three-day soak time, in the attempt to standardize catchability among trips. All strings will be reset in the same assigned location after each haul. The proposed sampling periods may vary but two hauling periods per month is the target intensity of this study with gear removed at the end of the survey period in October (i.e., no wet storage). Each trap string contains a total of six pots, alternating between vented and ventless traps. A single fish pot will be added to each string of lobster traps to collect general information on black sea bass as well as their relative predation rates on lobsters. The dimensions for all traps are standardized (40" x 21" x 16") throughout all survey areas and contain a single kitchen, parlor, and rectangular vent in the parlor of vented traps (size 1 15/16" x 5 ¾"). Ropeless ("on demand" or grappled) fishing gear will be deployed during the ventless trap survey meaning there will be no vertical down lines used to mark gear, as all deployments will use ropeless/on demand technology. All groundlines will be constructed of sinking line. The primary method for retrieving trap strings will be grappling, though on-demand systems will continue to be tested and potentially phased into the survey as the technology progresses and becomes logistically feasible. Temperature will be collected using methods described by Cassidy (2018). A Tidbit v2TM Temperature Logger, dissolved oxygen, pH, and salinity loggers will be placed on the middle trap of each string to compare CPUE and environmental factors.

Neuston Net Sampling
In tandem with the ventless trap survey, SouthCoast Wind will conduct a stratified random neuston tow survey to target neustonic American lobster larvae and other large ichthyoplankton in the SouthCoast Wind Lease Area and control areas during the months of May through October. Neuston net sampling will occur twice monthly to assess larval fish, crab, and lobster in the development and control area. The neuston net frame is 7.9 ft. x 2 ft. x 19.7 ft. (2.4 m x 0.6 m x 6 m) in size and the net is made of a 0.05-inch (1,320 micrometer) mesh. At the end of the net is a cod end for collecting samples. The sampling net will be deployed off the stern of commercial fishing vessels. At each ventless trap survey location (30 total) one tow at 4 knots of approximately 10 minutes each will be conducted and temperature, tow speed, and set and haul coordinates will be recorded.

Demersal Otter Trawl Surveys
The demersal otter trawl survey will be used to evaluate the impacts of development on demersal fish populations. This sampling consists of a net being towed behind a vessel along the seafloor expanded horizontally by a pair of otter boards or trawl doors. The methodology for the survey will be adapted from the Atlantic States Marine Fisheries Commission's (ASMFC) Northeast Area Monitoring and Assessment Program (NEAMAP) nearshore trawl survey. The survey trawl will be a 157 x 5 inch (400 x 12 centimeter), three-bridle, four-seam bottom trawl. This net style allows for a high vertical opening, relative to the size of the net, with consistent trawl geometry. These features make it a suitable net to sample a wide diversity of species with varying life history characteristics (i.e., demersal, pelagic, benthic, etc.). To effectively capture benthic organisms, a "flat sweep" will be used due to the soft bottom (i.e., sand, mud) in the survey area. To ensure the retention of small individuals, the net will have a five-inch (12-centimeter) diamond mesh cod end with a one-inch (2.5-centimeter) knotless liner. Trawls tend to be relatively indiscriminate in the fish and invertebrates they collect; hence trawls are a general tool for assessing fish communities along the seafloor and are widely used by institutions worldwide for fisheries and ecosystem monitoring.

The trawl survey area will encompass approximately 199 square miles (515 square kilometers) of SouthCoast Wind's Lease Area and adjacent control areas of similar size and depths, using a spatially balanced sampling method. Thirty tows will be conducted in the Lease Area and another thirty tows across the control areas per season (60 total tows per season). Surveys will be conducted seasonally during Spring (April-June), Summer (July-September), Fall (October-December), and Winter (January-March). Survey trawls will be towed for 20 minutes at each station at 3.0 knots. For each tow, data will be collected on trawl performance, aggregated species weights, individual biological sampling of fish (length, weight, etc.), and environmental conditions (temperature, salinity, weather, etc.). The survey will provide data on catch rates, population structure, and community composition using the BACI framework.

Drop Camera
The benthic optical drop camera survey uses the SMAST sampling pyramid that deploys three cameras (digital still and video) and estimates the substrate as well as 50 different invertebrate and fish species that associate with the sea floor. This survey will encompass the WDA and the two control areas, with a spatially balanced sampling method. There will be 126 stations in the Lease Area and 134 stations in the control areas arranged on a 0.8 square mile (2 square kilometer) grid. Samples will be collected on two surveys that target the spring and late summer (between April and September annually). Still and video imagery will be collected at each station to provide data on species composition, biomass, abundance, and habitat. The goal of the drop camera survey is to provide estimates of absolute abundance and species-specific distribution maps for flounders, red hake, crabs, lobster, sea scallops, and skates. In addition, the distribution of animal holes will also be mapped.

A drop camera pyramid will be deployed four times, roughly 164 feet (50 meters) apart, at each station. The pyramid will be equipped with two downward-looking cameras to provide quadrat 68 samples of the seafloor for all stations. Additionally, a third camera with a 6.5 square foot (0.6 square meter) view of the seafloor or a view parallel to the seafloor will also be deployed. At each station, images will be collected for laboratory review. Within each quadrat, epibenthic invertebrates (comprised of 50 total taxa that can include squid egg clusters or other organisms of interest) will be counted or noted as present and the substrate will be identified.

Acoustic Telemetry
SouthCoast Wind will conduct acoustic telemetry monitoring in Rhode Island State waters along the Brayton Point ECC at the mouth of the Sakonnet River using a 12-receiver array of fixed station acoustic receivers to monitor the movements, presence, and persistence of several commercially and recreationally important species (e.g., striped bass, summer flounder, tautog, and false albacore). Receivers will be deployed in early spring and retrieved in late fall to ensure seasonal overlap with the target species. Target fish species within the area in and around the receiver array will be captured via rod-and-reel, implanted with acoustic transmitters, and released back into the ocean.

Benthic Monitoring
SouthCoast Wind has developed a benthic monitoring plan for benthic habitats within the Lease Area and the Brayton Point ECC to evaluate detectable post-construction changes (INSPIRE 2024). Benthic monitoring will focus on determining changes to the benthic ecosystem associated with the development of the wind farm. Specifically, the monitoring will focus on documenting potential adverse outcomes associated with the introduction of novel surfaces

(foundations, scour protection, and cable protection layers) that act as artificial reefs, the artificial reef effect (epifaunal colonization) associated with the offshore wind structures that will lead to enrichment (fining and higher organic content) of surrounding soft bottom habitats resulting in shifts in benthic function (increased organic matter processing), and the physical disturbance of soft sediments and hard bottom during cable installation (including seafloor preparation) that will temporarily disrupt the function of the infaunal community. To assess the effect of the introduction of hard-bottom novel surfaces, a ROV stereo-camera system will be used to measure changes in benthic percent cover, identify key or dominant species, document non-native/invasive species, and compare findings across water depths in a stratified-random sampling design. To evaluate structure-oriented enrichment, sediment grab samples and SPI/PV will be used to measure changes in benthic function over time and with distance from foundations. For this objective, a stratified random selection of foundations within water depth contoured strata will be tested using a BAG design at each selected foundation. SPI/PV will again be used to measure benthic function over time and with distance from the cable centerline to assess cable-associated physical disturbance. A BAG design will be used to evaluate this objective within a stratified-random selection of cable segments.

ROV stereo camera surveys will monitor novel hard bottom habitats within subareas of the Project area, at structures selected using a stratified random design. The selected WTG and OSP foundations will be surveyed from the air-sea interface down to the seafloor and away from the structure to the edge of the scour protection layer using underwater image collection. For each selected foundation, the field team will collect images with a stereo camera. Images will be collected with auxiliary lights, with at least 50 percent overlap for all survey lines, with approximately 3.3-foot (1 meter) stand-off distance, in an overlapping pattern. Surveys will sample four replicate WTGs, randomly selected within each of two depth contour strata, <164 feet (<50 meters) and >164 feet (>50 meters). Surveys will scan and sample these replicate WTGs during each survey event. The hard bottom monitoring will occur in late spring/early fall for each survey. The initial baseline survey will occur during the first late spring/early fall following construction. The survey will then be repeated three years following construction. Results of the three-year post construction monitoring will be reviewed, and additional monitoring will be completed five years post construction, if needed.

3.5.3 Passive Acoustic and Other Environmental Monitoring

Moored passive acoustic monitoring (PAM) systems or mobile PAM platforms such as towed PAM, autonomous surface vehicles, or autonomous underwater vehicles may be used prior to, during, and following construction. PAM data may be used to characterize the presence of protected species, specifically marine mammals, through passive detection of vocalizations; to record ambient noise and marine mammal vocalizations in the Lease Area before, during, and after construction to monitor project impacts relating to project activities in the Lease Area. PAM devices may be required through COP approval, USACE permits, the MMPA LOA, and/or required as a term and condition of the biological opinion. In addition to specific requirements for monitoring surrounding the construction period, periodic PAM deployments may occur over the life of the Project for other scientific monitoring needs, as applicable and required by BOEM and/or NMFS. A detailed description of the PAM systems used for mitigation monitoring will be developed and submitted to NMFS and BOEM closer to the start of construction.

Weather and Meteorological Buoys
Additional meteorological buoys to provide real-time weather data and other data collection buoys may be temporarily deployed in the Project area during construction and operations. All buoy deployments will comply with the project design criteria and best management practices included in NMFS 2021 informal programmatic consultation on site assessment activities (NMFS 2021a; Appendix C to this Opinion). BOEM will require SouthCoast Wind to comply with all relevant programmatic survey and monitoring PDCs and BMPs included in the 2021 programmatic ESA consultation. Nevertheless, buoy deployments related to the SouthCoast Wind Project are considered part of the proposed action evaluated in this Opinion. The applicable PDCs and BMPs included in the 2021 programmatic ESA consultation are also elements of the proposed action evaluated in this Opinion.

3.6 Vessels and Aircraft

As described in the BA, various types of vessels will be used during construction and installation, O&M, and decommissioning. The construction and decommissioning phases would involve the most vessel based activity over relatively short-term periods, whereas O&M-related vessel traffic would occur intermittently over the life of the operational phase of the project. The information presented in the BA is summarized here. No new port facilities or facility upgrades are included as part of the proposed action undergoing consultation. A number of measures to avoid and minimize the risk of vessel strike are included in the proposed action (see Appendix A and B); these are discussed in detail in Section 7.2 *Effects of the Action*.

SouthCoast has identified various vessels and aircraft that would be used to support construction and operations and maintenance of the proposed project. As noted in the BA, each vessel would have operational Automatic Identification Systems (AIS), which would be used to monitor the number of vessels and traffic patterns for analysis and compliance with vessel speed requirements. All aviation operations, including flying routes and altitude, would be aligned with the Federal Aviation Administration, as necessary and applicable. Construction and installation vessels will operate over an approximately seven-year period (currently anticipated to begin in late 2026). SouthCoast Wind expects a daily average of 15–35 vessels depending on construction activities, with an expected maximum vessel peak of 50 vessels in the Lease Area at one time. O&M vessels will operate over an approximately 33-year period. Decommissioning vessels will operate over an approximately five-year period.

Table 3.5: Representative Vessels Proposed for Use for Project Construction (and Decommissioning) and Associated Ports

Construction						
Primary Ports for Construction (C) and Decommissioning (D)	**Vessel/Vehicle**	**Role**	**Approximate Length**	**Number of Vessels**	**Vessel speed (knots - Operation / Maximum)**	**Annual Round Trips**
N/A	Airplane	Marine mammal watch if required, general support	15 m	1-2	100-120 kn	140

Construction						
Primary Ports for Construction (C) and Decommissioning (D)	**Vessel/Vehicle**	**Role**	**Approximate Length**	**Number of Vessels**	**Vessel speed (knots - Operation / Maximum)**	**Annual Round Trips**
N/A	Drones	Onsite inspection, marine mammal monitoring and identification if required	1.25 m	1-5	0 – 100 mph	N/A
N/A	Helicopter	Crew changes, part transport, general support	16 m	1-4	100 – 145 kn	520
Port of New Bedford (C,D) Port of Providence (C,D) Port of New London (C,D) Port of Fall River (C) Port of Salem (D)	Anchor Handling tug	Anchor handling, general support	60 m	1-10	10 kn / 15 kn	15
Port of New Bedford (C,D) Port of New London (C,D) Port of Providence (C,D) Port of Fall River (C,D) Sparrows Point Port (C) Port of Charleston (C) Port of Salem (D)	Cable Lay Barge	Transportation and installation of EC and IAC and/or dredging	80 m	1-3	<5 kn / 15 kn	240
Port of New Bedford (C,D) Port of New London (C,D) Port of Providence (C,D) Port of Fall River (C,D) Sparrows Point Port (C) Port of Charleston (C) Port of Salem (D) US, European, or Canadian ports (C) - location unknown at this time	Cable Transport and Lay Vessel	Transportation and installation of EC and IAC and/or cable burial	130 m	1-5	2 kn / 11.5 kn	10
Port of New Bedford (C,D) Port of New London (C,D) Port of Fall River (C,D)	Crew Transfer Vessel	Commissioning, crew transport, general operations, environmental monitoring, and marine mammal observers	25 – 40 m	2-5	10 kn / 35 kn	140

Construction						
Primary Ports for Construction (C) and Decommissioning (D)	Vessel/Vehicle	Role	Approximate Length	Number of Vessels	Vessel speed (knots - Operation / Maximum)	Annual Round Trips
Port of New London (C,D) Port of New Bedford (C) Port of Providence (C) Port of Salem (D) US, European, or Canadian ports (C) - location unknown at this time	Dredging vessel	Seabed preparation, inspection, mattress installation, general support	175 m	1-5	2 kn / 15 kn	30
Not anticipated in port; round trips are to safe waters during storm events and entry from Foreign location to OCS Site	Heavy Lift Crave Vessel	Transport, transfer and installation of substructures, WTGs, OSPs, and related components	225 m	1-5	0 kn / 15 kn	10
Port of New Bedford (C,D) Port of New London (C,D) Port of Providence (C,D) Port of Davisville (C) Port of Altamira (C) Port of Salem (D) US, European, or Canadian ports (C) - location unknown at this time	Heavy Transport Vessel	Transportation of substructures, WTGs, OSPs, and other project components	300 m	1-20	12 kn / 15 kn	5
Not anticipated in port; round trips are to safe waters during storm events and entry from Foreign location to OCS Site	Jack-up Accommodation Vessel	Commissioning activities	70 m	1-2	0 kn / 15 kn	15
Not anticipated in port; round trips are to safe waters during storm events and entry from Foreign location to OCS Site	DP Accommodation Vessel	Commissioning activities	100 m	1-2	0 kn / 15 kn	5
Port of New Bedford (C,D) Port of New London (C,D) Port of Providence (C,D) Port of Fall River (C,D) Port of Davisville (C) Port of Salem (D)	Multipurpose Support Vessel	Seabed preparation, inspection, mattress installation, diving, general support, environmental monitoring and marine mammal observers, noise mitigation, pre and post installation inspection	100 m	1-8	10 kn / 15 kn	1,020

Construction						
Primary Ports for Construction (C) and Decommissioning (D)	**Vessel/Vehicle**	**Role**	**Approximate Length**	**Number of Vessels**	**Vessel speed (knots - Operation / Maximum)**	**Annual Round Trips**
Port of Salem (C,D) Port of New London (C) US, European, or Canadian ports (C) - location unknown at this time	Scour protection installation vessels	Scour protection installation	175 m	1-2	2 kn / 15 kn	520
Port of New Bedford (C,D) Port of New London (C,D) Port of Providence (C,D) Port of Fall River (C,D) Port of Davisville (C) Port of Salem (C,D)	Service Operations Vessel	Commissioning using SOV, general operations	60 – 100 m	1-4	10 kn / 25 kn	70
Port of New Bedford (C,D) Port of New London (C,D) Port of Providence (C,D) Port of Fall River (C) Port of Salem (C,D)	Survey Vessel	Specialized survey work, if required	60 m	1-5	2 kn / 12 kn	5
Port of New Bedford (C,D) Port of New London (C,D) Port of Providence (C,D) Port of Fall River (C) Port of Davisville (C) Port of Corpus Christi (C) Port of Altamira (C) Port of Salem (C,D)	Tugboat	Transportation to site from staging port, port operations	50 m	1-12	5 kn / 16 kn	510
Port of New Bedford (C,D) Port of New London (C,D) Port of Providence (C,D) Port of Fall River (C) Port of Davisville (C) Port of Corpus Christi (C) Port of Altamira (C) Port of Salem (C,D)	Barge	Transportation of components to site from staging port	122 m	1-6	N/A	N/A

Table 3.6: Representative Vessels Proposed for Use for Project Operation and Maintenance

Operation and Maintenance

Primary Ports for O&M	Vessel/Vehicle	Vessel Role	Approximate Length	Number of Vessels	Vessel speed (Operation / Maximum)	Annual Round Trips (Monthly Round Trips
Port of Fall River Port of New Bedford Port of New London	Maintenance Crew/CTVs	Crew and technician transfer	20 – 40 m	1-4	10 kn / 35 kn	100 (4)
Port of Fall River Port of New Bedford Port of New London Port of Providence Port of Davisville	Multi-purpose Support Vessel/SOV	Supply and support stationed in Project Area	60 – 100 m	1	10 kn / 25 kn	24 (2)
Port of Fall River Port of Providence Port of New Bedford Port of New London	Anchor Handling Tugs	Cable inspection and repairs	60 m	1-2	10 kn / 15 kn	1 (As needed)
Not anticipated in port; round trips are to safe waters during storm events	Heavy Lift/ Jack-up Vessel with Crane	Large scale repairs	225 m	1-2	0 kn / 12.5 kn	1 (As needed)
Port of New London Port of Salem	Scour Vessel or Barge	Scour top-up	175 m	1	2 kn / 15 kn	1 (As needed)
Port of Fall River Port of New Bedford Port of New London Port of Providence Port of Davisville	Inspection/survey vessel (Potentially ROV)	Inspection of cables of for additional geo surveys	70-100 m	1-2	10 kn / 14 kn	2 (As needed)
N.A	Helicopter	Crew support or small supply delivery	16 m	1-2	100 – 145 kn	250
N/A	Drone	Future potential for inspection or parts delivery	1.25 m	1-4	0 – 100 mph	N/A

Source: SouthCoast Wind COP Table 3-21, Table 3-23, and BA Table 3.1-15. Note: A higher percentage of the total anticipated vessel trips per vessel type were allotted to ports that have a higher chance of being selected. To avoid significantly overestimating of the number of trips per vessel type, trips were not duplicated for the scenarios where multiple ports are under consideration. Where multiple ports are considered to have a high chance of selection, additional trips were added to those ports per vessel type to ensure SouthCoast Wind did not significantly underestimate the potential vessel trips from that port.
Note: Numbers for annual round trip are high estimates. Actual numbers will be lower through a combination use of these three (CTV, SOV, Helicopter) different vessels.

In the BA BOEM identifies the potential for up to 341 transits of scour protection, dredging, and heavy transport vessels carrying project components from ports in Canada, Europe, or Asia directly to the WDA or one of the identified US ports. These trips will occur at some time during the approximately seven-year construction phase. The ports that these vessels will originate from in Canada, Europe, or Asia and the vessel routes from those port facilities to the project site are unknown and will be variable and depend, on a trip-by-trip basis, on weather and sea-state conditions, other vessel traffic, and any maritime hazards.

The number and type of vessels required for project decommissioning would be similar to those used during project construction, with the exception that impact pile driving would not be required. As such, while the same class of vessel used for foundation installation may be used for decommissioning, that vessel would not be equipped with an impact hammer. In the BA, BOEM has indicated that it is difficult to predict the amount of vessel traffic and the ports to be used to support decommissioning but that they are expected to be substantially similar to vessel traffic during construction.

3.7 MMPA Incidental Take Authorization (ITA) Proposed for Issuance by NMFS

In response to their application, the NMFS Office of Protected Resources (OPR) has proposed to issue SouthCoast Wind an ITA for the take of small numbers of marine mammals incidental to construction of the project with a proposed duration of five years, it is anticipated that the proposed regulation would be effective from April 1, 2027 through March 31, 2032. More information on the proposed Incidental Take Regulation (ITR) and associated Letter of Authorization (LOA), including SouthCoast Wind's application is available online (*https://www.fisheries.noaa.gov/action/incidental-take-authorization-southcoast-wind-llc-construction-southcoast-wind-offshore-wind*). As described in the Notice of Proposed Rule (89 FR 53708; June 27, 2024), take of marine mammals may occur incidental to the construction of the project due to in-water noise exposure resulting from Project activities likely to result in incidental take include foundation installation (impact and vibratory), detonation of unexploded ordnance (UXO/MEC), and vessel-based site assessment surveys using high-resolution geophysical (HRG) equipment. As described in the proposed rule, the regulations would apply to the identified actions carried out in the specified geographical region, defined as:

> the Mid-Atlantic Bight and vessel transit routes to marshaling ports in Charleston, South Carolina and Sheet Harbor, Canada. The Mid-Atlantic Bight extends between Cape Hatteras, North Carolina and Martha's Vineyard, Massachusetts, extending westward into the Atlantic to the 100-m isobath and includes, but is not limited to, the Bureau of Ocean Energy Management (BOEM) Lease Area Outer Continental Shelf (OCS)-A-0521 Commercial Lease of Submerged Lands for Renewable Energy Development, two export cable routes, and two sea-to-shore transition point at Brayton Point in Somerset, Massachusetts and Falmouth, Massachusetts.

Note that in October 2024, in response to a request from NMFS OPR, SouthCoast submitted a revised modeling report (LGL 2024) that addresses NMFS draft Updated Acoustic Guidance. NMFS OPR submitted revisions to their proposed MMPA action to us following review of that report; the text below incorporates these revisions.

3.7.1 MMPA Take Proposed for Authorization

The proposed ITA would be effective for a period of five years, and, if issued as proposed, would authorize Level A and Level B harassment as the only type of take of ESA listed marine mammals expected to result from activities during the construction phase of the project. Section 3(18) of the Marine Mammal Protection Act defines ''harassment'' as any act of pursuit, torment, or annoyance, which (i) has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment); or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B harassment). It is important to note that the MMPA definition of harassment is not the same as the ESA definition. This issue is discussed in further detail in Section 7.0 *Effects of the Action* of this Opinion.

Take Proposed for Authorization under the MMPA
The methodology for estimating marine mammal exposure and incidental take is described fully in the MMPA Proposed Rule (89 FR 53708, June 27, 2024), an October 2024 report submitted by SouthCoast in response to NMFS 2024 draft Updated Acoustic Guidance (LGL 2024), and is discussed further in the *Effects of the Action*. As described in the Proposed Rule, NMFS OPR estimated the amount of take by considering: (1) acoustic thresholds above which NMFS OPR determined the best available scientific information indicates marine mammals will be behaviorally harassed, including temporary effects to hearing sensitivity (Level B) or incur some degree of permanent hearing impairment (Level A); (2) the area or volume of water that will be ensonified above these levels in a day; (3) the density or occurrence of marine mammals within these ensonified areas; and, (4) the number of days of activities. NMFS OPR is proposing to authorize MMPA take of ESA listed marine mammals resulting from potential noise exposure from installation of foundation piles (impact and vibratory pile driving), UXO detonations, and HRG surveys.

Installation of Piles with Impact and Vibratory Pile Driving
As described in the MMPA Proposed Rule, modeling (Limpert et al. 2024) has been completed to estimate the sound fields associated with a number of noise producing activities and to estimate the number of individuals predicted to be exposed to noise above identified thresholds. This modeling was supplemented as described in LGL 2024. Table 3.8 shows the number of Level A and Level B harassment takes proposed to be authorized incidental to impact and vibratory pile driving for the installation of a total of 149 WTG and OSP foundations, assuming 10 dB attenuation (as required by conditions of the proposed ITA).

Table 3.7. MMPA Take of ESA Listed Species by Level A and B Harassment Proposed for Authorization through the MMPA ITA Resulting from Impact and Vibratory Pile Driving for WTG and OSP Foundation Installation

Species	**Level A Harassment**	**Level B Harassment**
Blue whale	0	2
Fin whale	7	520
North Atlantic right whale	0	109
Sei whale	0	47
Sperm whale	0	135

Source: Table 37, 89 FR 53708, as updated by NMFS OPR during the consultation period in consideration of updated modeling (LGL 2024)

Potential UXO/MEC Detonations
As described in the MMPA Proposed Rule, for potential UXO detonations, acoustic modeling (Limpert et al. 2024) was conducted to determine distances to thresholds for behavioral disturbance, temporary threshold shift (TTS), permanent threshold shift (PTS), and non-auditory injury. This modeling was supplemented as described in LGL 2024. Table 3.9 shows the number of Level B harassment takes that NMFS OPR is proposing to authorize incidental to the detonation of up to 10 UXOs, assuming 10 dB of sound attenuation (as required by the Proposed ITA).

Table 3.8. MMPA Take of ESA Listed Species by Level B Harassment Proposed for Authorization through the MMPA ITA from the Detonation of up to 10 UXOs, Assuming 10 dB of Sound Attenuation

Species		**Level B Harassment (TTS)**
Blue whale		2
Fin whale		49
North Atlantic right whale		28
Sei whale		16
Sperm whale		4

Note: No take of any ESA listed species by Level A harassment is proposed for authorization
Source: Table 44, 89 FR 53708, as updated by NMFS OPR during the consultation period in consideration of updated modeling (LGL 2024)

HRG Surveys
The MMPA Proposed Rule includes a description of the modeling used to predict the number of incidental take proposed for authorization under the MMPA. This modeling was supplemented as described in LGL 2024. The number of Level B harassment takes proposed for authorization by NMFS OPR is illustrated in Table 3.9.

Table 3.9. MMPA Take of ESA Listed Species by Level B Harassment Proposed for Authorization through the MMPA ITA Resulting from High-Resolution Geophysical Surveys (over 5 years)

Species	**Level B Harassment**
Blue whale	5
Fin whale	24

North Atlantic right whale	31
Sei whale	10
Sperm whale	10

Source: Tables 49 and 50, 89 FR 53708, as updated by NMFS OPR during the consultation period in consideration of updated modeling (LGL 2024)

3.7.2 Mitigation Measures Included in the Proposed ITA

The proposed ITA includes a number of minimization and monitoring methods that are designed to ensure that the proposed project has the least practicable adverse impact upon the affected marine mammal species or stocks and their habitat and would be required to be implemented by SouthCoast Wind. The proposed ITA, inclusive of the proposed mitigation requirements, has been published in the FR (89 FR 53708). The proposed mitigation measures include restrictions on timing for pile driving, establishment of minimum visibility and clearance zones for all activities, shutdown measures, soft start of pile driving, ramp up of HRG sources, noise mitigation for impact pile driving, and vessel strike avoidance measures. For the purposes of this Section 7 consultation, all minimization and monitoring measures included in the ITA proposed by NMFS OPR are considered as part of the proposed action for this consultation. We note that some of the measures identified here overlap or are duplicative with the measures described by BOEM in the BA as part of the proposed action (Appendix A as referenced above). The mitigation measures included in the June 2024 Proposed ITA are listed in Appendix B.

3.8 Minimization and Monitoring Measures that are part of the Proposed Action

There are a number of measures that SouthCoast Wind, through its COP, is proposing to take and/or BOEM and/or USACE is proposing to require as conditions of their respective authorizations that are designed to avoid, minimize, or monitor effects of the action on ESA listed species. For the purpose of this consultation, the mitigation and monitoring measures proposed by BOEM and/or USACE and identified in the BA as part of the action that BOEM is requesting consultation on are considered as part of the proposed action. Additionally, NMFS OPR includes a number of measures to avoid, minimize, or monitor effects in the proposed MMPA ITA; these measures are also considered as part of the proposed action for this consultation. The ITA only proposes mitigation and monitoring measures for marine mammals including the threatened and endangered whales considered in this Opinion and those measures are only in place for the 5-year effective period of the ITA. Although some measures for marine mammals also apply to and provide minimization of potential impacts to listed sea turtle and fish species (e.g., pile driving soft start minimize potential effects to all listed species), they do not completely cover all threatened and endangered species mitigation, monitoring, and reporting needs. The measures considered as part of the proposed action, and thus mandatory for implementation, are described in Table 3.3-1 of BOEM's BA and for ease of reference, are copied into Appendix A of this Opinion. These are in addition to the conditions of the proposed ITA, which are also part of the proposed action (see Appendix B). We note that the final MMPA ITA may contain measures that include requirements that may differ from the proposed rule; as explained in this Opinion's ITS, compliance with the conditions of the final MMPA ITA is necessary for the ESA take exemption to apply to ESA-listed marine mammals. We therefore consider any measures specified in the proposed MMPA ITA to be mandatory elements of the proposed action while acknowledging that they may be modified or supplemented in the final MMPA ITA. We also note that while the applicant will be separately required by the final MMPA ITA to comply with any such additional measures, this consultation's Effects Analysis and Conclusion do not rely on any such additional measures not already identified here as part of the proposed action (i.e., those measures proposed by SouthCoast Wind, identified in BOEM's BA, or in the MMPA Proposed Rule. We will review the final rule and any modified or additional mitigation measures to determine whether our effects analysis and conclusions may need to be modified.

BOEM and NMFS OPR are proposing to require monitoring of clearance and shutdown zones before and during pile driving as well as clearance zones prior to UXO detonation. More information is provided in Section 5.0 *Effects of the Action* of this Opinion. These zones are summarized in Tables 3.10 and 3.11 below. In addition to the clearance and shutdown zones, the MMPA ITA identifies minimum visibility zones for pile driving of WTG and OSP foundations. These are the distances from the pile that the visual observers must be able to effectively monitor for marine mammals; that is, lighting, weather (e.g., rain, fog, etc.), and sea state must be sufficient for the observer to be able to detect a marine mammal within that distance from the pile.

The clearance zone is the area around the pile or UXO that must be declared "clear" of marine mammals and sea turtles prior to the activity commencing. The size of the zone is measured as the radius with the impact activity (i.e., pile or UXO) at the center. For sea turtles, the area is "cleared" by visual observers determining that there have been no sightings of sea turtles in the identified area for a prescribed amount of time. For marine mammals, both visual observers and passive acoustic monitoring (PAM, which detects the sound of vocalizing marine mammals) will be used; the area is determined to be "cleared" when visual observers have determined there have been no sightings of marine mammals in the identified area for a prescribed amount of time and, for North Atlantic right whales in particular, if no right whales have been visually observed in any area within or beyond the minimum clearance zone that the visual observers can see. Further, the PAM operator will declare an area "clear" if they do not detect the sound of vocalizing right whales within the identified PAM clearance zone for the identified amount of time. Pile driving or UXO detonation cannot commence until all of these clearances (i.e. visual and PAM) are made. Note that there are additional clearance requirements in the NARW EMA as identified in the MMPA Proposed Rule. Within the NARW EMA August 1- October 15 and throughout the Lease Area May 16-31 and December 1-31, for any acoustic detection within the North Atlantic right whale PAM clearance and shutdown zones or sighting of 1 or 2 North Atlantic right whales, SouthCoast Wind must delay commencement of or shutdown pile driving for 24 hours. For any sighting of 3 or more North Atlantic right whales, SouthCoast Wind must delay commencement of or shutdown pile driving for 48 hours. Prior to beginning clearance at the pile driving location after these periods, SouthCoast must conduct a vessel-based survey to visually clear the 10-km (6.2-mi) zone, if installing pin piles that day, or 15-km (9.32- mi) zone, if installing monopiles. Clearance and shutdown requirements are also addressed in Section 7.1.

Once pile driving begins, the shutdown zone applies. There is no shutdown zone for UXO detonation as once a detonation begins it cannot be stopped; additionally, the duration of the detonation is extremely short (one second). If a marine mammal or sea turtle is observed by a visual PSO entering or within the respective shutdown zones after pile driving has commenced, an immediate shutdown of pile driving will be implemented unless SouthCoast Wind and/or its contractor determines shutdown is not feasible due to an imminent risk of injury or loss of life to an individual; or risk of damage to a vessel that creates risk of injury or loss of life for individuals. For right whales, shutdown is also triggered by: the visual PSO observing a right whale at any distance (i.e., even if it is outside the shutdown zone identified for other whale species), or a detection by the PAM operator of a vocalizing right whale at a distance determined to be within the identified PAM shutdown zone. If shutdown is called for but SouthCoast Wind and/or its contractor determines shutdown is not feasible due to risk of injury or loss of life, reduced hammer energy must be implemented when the lead engineer determines it is practicable. There are two scenarios, approaching pile refusal and pile instability, where this imminent risk could be a factor; however, BOEM describes a low likelihood of occurrence for the pile refusal/stuck pile or pile instability scenario as explained below.

Stuck Pile
If the pile driving sensors indicate the pile is approaching target depths and/or refusal, and a shut-down would lead to a stuck pile, shut down may be determined to be infeasible if the stuck pile is determined to pose an imminent risk of injury or loss of life to an individual, or risk of damage to a vessel that creates risk for individuals. This risk comes from the instability of a pile that has not reached a penetration depth where the pile would be considered stable. The pile could then fall and damage the vessel and/or personnel on board the vessel. This risk is minimized as each pile is specifically engineered to manage the sediment conditions at the location at which it is to be driven, and therefore designed to avoid and minimize the potential for piling refusal. The lessee will use pre-installation engineering assessments with real-time hammer log information during installation to track progress and continuously judge whether a stoppage would cause a risk of injury or loss of life. Due to this advanced engineering and on-site construction, BOEM and the lessee expect that circumstances under which piling could not stop if a shutdown is requested are very limited.

Pile Instability
A pile may be deemed unstable and unable to stay standing if the piling vessel were to “let go.” During these periods of instability, the lead engineer may determine a shut-down is not feasible because the shutdown combined with impending weather conditions may require the piling vessel to “let go” which then poses an imminent risk of injury or loss of life to an individual, or risk of damage to a vessel that creates risk for individuals from a falling pile. As described by BOEM, weather conditions criteria will be established that determine when a piling vessel would have to “let go” of a pile being installed for safety reasons. To reduce the risk that a requested shutdown would not be possible due to weather, project personnel will actively assess weather, using two independent forecasting systems. Initiation of piling also requires a Certificate of Approval by the Marine Warranty Supervisor. In addition to ensuring that current weather conditions are suitable for piling, this Certificate of Approval process considers forecasted weather for 6 hours out and will evaluate if conditions would limit the ability to shut down and “let go” of the pile. If a shutdown is not feasible due to pile instability and weather, piling would

continue only until a penetration depth sufficient to secure the pile is achieved. As piling instability is most likely to occur during the soft start period, and soft start cannot commence until the Marine Warranty Supervisor has issued a Certificate of Approval that signals there is a current weather window, the likelihood is low for the pile to not achieve stability within the approved window inclusive of stops and starts.

The PAM detection, minimum visibility, clearance and shutdown zones incorporated into the proposed action; the zones for marine mammals reflect the proposed conditions of the MMPA ITA, and the zones for sea turtles reflect the zone sizes proposed by BOEM in the BA can be found below in Table 3.10 (Pile driving), Table 3.11 (UXO Detonations), and Table 3.12 (HRG Surveys). Pile driving will not proceed unless the PSOs can effectively monitor the full extent of the minimum visibility zones. Detection of an animal within the clearance zone triggers a delay of initiation of pile driving; detection of an animal in the shutdown zone triggers the identified shutdown requirements. SouthCoast must submit, for BOEM and NMFS review and approval, a monitoring plan (described in the BA as the Alternative Monitoring Plan (AMP)) that would describe details and efficacy of the monitoring methods and technologies that will be used to monitor the entire clearance and shutdown zones in low-visibility conditions during daylight hours (i.e., if there was unexpected fog or in the event that pile driving could not be completed before sunset and had to continue after dark for safety reasons).

Initiating Pile Driving After Dark

Prior to initiating pile driving at night, SouthCoast Wind would be required to submit a Nighttime Pile Driving Plan (NPDP) to BOEM and NMFS for concurrence that the proposed monitoring technology will meet the identified requirements. The NPDP will describe the methods, technologies, monitoring zones, and mitigation requirements for any nighttime pile driving activities, which would occur between 1.5 hours before civil sunset to one hour after civil sunrise. In the absence of an approved NPDP, all pile driving would be initiated during daytime (i.e., between one hour after civil sunrise to 1.5 hours before civil sunset), and nighttime pile driving could only occur if unforeseen circumstances prevent the completion of a foundation started during daylight hours and was deemed necessary to finish piling during the night to protect asset integrity and/or safety.

Table 3.10: Clearance, Shutdown, and Minimum Visibility Zones, in meters (m), during Sequential and Concurrent Installation of 9/16-m Monopiles and 4.5-m Pin Piles

Installation Order	**Sequential**						**Concurrent**	
Pile Type	**9/16-m Monopile**	**4.5-m Pin Pile**	**9/16-m Monopile**		**4.5-m Pin Pile**		**WTG Mono + 4 OSP Pin Piles**	**4 WTG Pin + 4 OSP Pin Piles**
Method	**Impact Only**		**Impact**	**Vibratory**	**Impact**	**Vibratory**	**Impact Only**	
Minimum Visibility zone: Within NARW EMA: 4,800 m (pin piles); 7,400 m (monopiles). Outside NARW EMA: equivalent to blue/fin/sei whale clearance zone								
NARW Visual Clearance/Shutdown zone*	Sighting at Any Distance from PSOs on Pile-Driving or Dedicated PSO Vessels triggers a delay or shutdown (minimum visibility zone plus any additional distances observable by the visual PSOs on any PSO platform).							
NARW PAM Clearance/Shutdown Zone[1]	10,000 m (pin), 15,000 m (monopole)							
Blue, Fin, Sei Whale Clearance/Shutdown Zone Summer (Winter)	4,000 m (4,100 m)	2,300 m (2,700 m)	4,200 m	400 m	2,300 m	NAS[1]	4,000 m	3,000 m
Sperm Whales Visual Clearance/Shutdown Zone	NAS	NAS	NAS	NAS	NAS	NAS	NAS	NAS
Sea Turtles Visual Clearance/Shutdown Zone	200 m	200 m	200 m	200 m	200 m	200 m	200 m	200 m

NAS = noise attenuation system (e.g., double bubble curtain (DBBC)). This zone size designation indicates that the clearance and shutdown zones, based on modeled distances to the Level A harassment thresholds, would not extend beyond the DBBC deployment radius around the pile.
1 – The PAM system used during clearance must be designed to detect marine mammal vocalizations, maximize baleen whale detections, and must be capable of detecting North Atlantic right whales at 10 km and 15 km for pin piles and monopile installations, respectively. NMFS recognizes that detectability of each species' vocalizations will vary based

on vocalization characteristics (e.g., frequency content, source level), acoustic propagation conditions, and competing noise sources), such that other marine mammal species (e.g., harbor porpoise) may not be detected at 15 km (9.3 mi).
2 – PSOs must be able to visually monitor minimum visibility zones. To provide enhanced protection of North Atlantic right whales during foundation installations in the NARW EMA, SouthCoast proposed monitoring of minimum visibility zones equal to the Level B harassment zones when installing pin piles (4.8 km (3.0 mi)) and monopiles (7.4 km (4.6 mi)). Outside the NARW EMA, the minimum visibility zone would be equal to SouthCoast's clearance/shutdown zones for 'other baleen whales
(Source Table 54, 89 FR 53708 and SouthCoast Wind BA [for sea turtles, as modified during the consultation period])
*Within the NARW EMA August 1- October 15 and throughout the Lease Area May 16-31 and December 1-31, for any acoustic detection within the North Atlantic right whale PAM clearance and shutdown zones or sighting of 1 or 2 North Atlantic right whales, SouthCoast Wind must delay commencement of or shutdown pile driving for 24 hours. For any sighting of 3 or more North Atlantic right whales, SouthCoast Wind must delay commencement of or shutdown pile driving for 48 hours. Prior to beginning clearance at the pile driving location after these periods, SouthCoast must conduct a vessel-based survey to visually clear the 10-km (6.2-mi) zone, if installing pin piles that day, or 15-km (9.32-mi) zone, if installing monopiles;

Table 3.12: Clearance Zones during UXO/MEC Detonations in the Export Cable Corridor (ECC) and Wind Farm Area (WFA), by Charge Weight and Assuming 10 dB of Sound Attenuation

UXO/MEC Weight Charge	NARW, Blue, Fin, and Sei Whales		Sperm Whales		Sea Turtles
	ECC	WFA	ECC	WFA	All Sites
PAM Clearance Zone*	15,000 m				N/A
E4 (2.3 kg) Clearance Zone	800 m	400 m	100 m	50 m	500 m
E6 (9.1 kg) Clearance Zone	1,500 m	900 m	200 m	50 m	
E8 (45.5 kg) Clearance Zone	2,900 m	1,900 m	300 m	100 m	
E10 (227 kg) Clearance Zone	4,200 m	3,500 m	500 m	300 m	
E12 (454 kg) Clearance Zone	4,900 m	4,500 m	700 m	400 m	

*The PAM system used during clearance must be designed to detect marine mammal vocalizations, maximize baleen whale detections, and must be capable of detecting North Atlantic right whales at 15 km (9.3 mi). NMFS recognizes that detectability of each species' vocalizations will vary based on vocalization characteristics (e.g., frequency content, source level), acoustic propagation conditions, and competing noise sources), such that other marine mammal species (e.g., harbor porpoise) may not be detected at 15 km (9.3 mi).
(Source: Table 55, 89 FR 53708 and updates provided by NMFS OPR during the consultation period)

Table 3.13: Clearance Zones for HRG Surveys

HRG Surveys – visual PSOs		
Species	**Clearance Zone**	**Shutdown Zone**
NARW	500 m	500 m
Blue, Fin, Sei, and Sperm Whales	100 m	100 m
Sea Turtles	100 m	100 m

(Source: Table 56, 89 FR 53708 and SouthCoast Wind BA [for sea turtles])

3.9 Action Area

The action area is defined in 50 CFR 402.02 as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." Effects of the action are defined in 50 CFR 402.02 as "all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action."

The action area includes the WDA where construction, operations and maintenance, and decommissioning activities will occur and the surrounding areas ensonified by noise from project activities; the cable corridors; and the areas where HRG and biological resource surveys will take place. Additionally, the action area includes the U.S. EEZ along the Atlantic and Gulf coasts; this includes the vessel transit routes between the WDA and ports in Massachusetts, Rhode Island, Connecticut, South Carolina, and Texas. As explained below, it does not include a portion of the vessel transit routes between the WDA and ports in Canada, Europe, or Asia outside the U.S. EEZ as we have determined that the effects of vessel transit from those ports are not effects of the proposed action as defined in 50 CFR 402.17.

In the BA (Table 1-10), BOEM identifies the potential for up to 341 round trip vessel transits associated with the proposed project to originate from ports in Canada, Europe, or Asia (156 round trips to unidentified ports in Europe or Asia and 185 round trips distributed between Sheet Harbor, Port of Sydney, and Port of Argentina in Canada). Up to 10 trips could travel through the Panama Canal. These trips will occur at some time during the approximately 7-year period when construction and installation vessels are operating, for an average of approximately 57 trips per year. The ports that these vessels will originate from in Canada or Europe and the vessel routes from those port facilities to the project site are largely unknown and will be variable and depend, on a trip-by-trip basis, on weather and sea-state conditions, other vessel traffic, and any maritime hazards. These vessels are expected to enter the U.S. EEZ along the Atlantic or Gulf Coast or through the Panama Canal and then travel along established traffic lanes and fairways until they approach the lease area. Because the ports of origin and vessel transit routes are unknown, we are not able to identify what areas outside the U.S. EEZ will be affected directly or indirectly by the Federal action; that is, while we recognize that there will be vessel trips outside of the U.S. EEZ that would not occur but for the approval of SouthCoast Wind's COP, we cannot identify what areas vessel transits will occur as a result of BOEM's proposed approval of SouthCoast Wind's COP. Though these vessel transits may be caused by the proposed action, without specific information including vessel types and size, the ports of origin, and, the location, timing and routes of vessel transit, we cannot predict that specific consequences of these activities on listed species[9] are reasonably certain to occur, and they are therefore not considered effects of the proposed action. 50 CFR 402.17(a)-(b). Therefore, the action area is limited to the U.S. EEZ off the Atlantic coast of the United States extending from the Texas/Mexico border in the Gulf of Mexico around the eastern Atlantic coast north to the Maine/Canada border.

4.0 SPECIES AND CRITICAL HABITAT NOT CONSIDERED FURTHER IN THIS OPINION

[9] In an abundance of caution, we have considered the risk that these vessel trips may pose to ESA listed species that may occur outside the US EEZ. We have determined that these species fall into two categories: (1) species that are not known to be vulnerable to vessel strike and therefore, we would not expect a project vessel to strike an individual regardless of the location of the vessel; or (2) species that may generally be vulnerable to vessel strike but outside the US EEZ, co-occurrence of project vessels and individuals of those ESA listed species are expected to be extremely unlikely due to the seasonal distribution and dispersed nature of individuals in the open ocean, and intermittent presence of project vessels. These factors make it extremely unlikely that there would be any effects to ESA listed species from the operation of project vessels outside the EEZ.

In the BA, BOEM addresses a number of species and designated critical habitat that may occur in the action area but either will not be affected by the proposed action (i.e., the proposed action will have no effect on the species) or for which all effects will be insignificant or discountable (i.e., the proposed action may affect but is not likely to adversely affect the species). A "not likely to adversely affect" determination is appropriate when an effect is expected to be discountable, insignificant, or completely beneficial. As discussed in the FWS-NMFS Joint Section 7 Consultation Handbook (1998), "[b]eneficial effects are contemporaneous positive effects without any adverse effects to the species. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur. Based on best judgment, a person would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur. If an effect is beneficial, discountable, or insignificant it is not considered adverse and thus cannot cause "take" of any listed species. "Take" means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct" (ESA §3(19)). Here, we address those species and designated critical habitat identified in BOEM's BA and present our own analysis of potential effects.

In Section 4.9 of the BA, BOEM addresses humpback whales and scalloped hammerhead sharks. The endangered Cape Verde/Northwest Africa DPS of humpback whales does not occur in the action area; therefore, the proposed action will have no effect on this DPS. There are no ESA listed DPSs of humpback whales that occur in the action area. While scalloped hammerheads occur in the Northwest Atlantic and Gulf of Mexico, those individuals are part of DPSs that are not listed under the ESA (79 FR 38214, July 3, 2014). The Southwest Atlantic DPS of scalloped hammerheads is listed as threatened under the ESA; however, the action area does not overlap with the range of the Southwest Atlantic DPS (see Figure 1 in 79 FR 38214). Similarly, the Eastern Atlantic DPS of scalloped hammerhead sharks does not occur in the action area. Thus, there are no ESA listed scalloped hammerhead sharks in the action area: the action will have no effects on ESA listed scalloped hammerhead sharks.

4.1 ESA Listed Species

Gulf of Maine DPS of Atlantic salmon (Salmo salar) – Endangered

The only remaining populations of Gulf of Maine DPS Atlantic salmon are in Maine. Smolts migrate from their natal rivers in Maine north to foraging grounds in the Western North Atlantic off Canada and Greenland (Fay et al. 2006). After one or more winters at sea, adults return to their natal river to spawn. Atlantic salmon do not occur in the WDA or where surveys will occur. While in the U.S. EEZ, vessels transiting to/from Canada could overlap with the marine distribution of Atlantic salmon. However, even if migrating salmon occurred along the routes of these vessels, we do not anticipate any effects to Atlantic salmon. There is no evidence of interactions between vessels and Atlantic salmon and we do not anticipate any effects from exposure to vessel noise. Vessel strikes are not identified as a threat in the listing determination (74 FR 29344) or the recovery plan (USFWS and NMFS, 2019). We have no information to suggest that vessels in the ocean have any effects on migrating Atlantic salmon, and we do not expect there would be any due to Atlantic salmon migrating at depths below the draft of project vessels. No effects from potential exposure to vessel noise are anticipated. Therefore, we do not expect any effects to Atlantic salmon even if migrating individuals co-occur with project vessels moving between the project site and ports in Canada. The proposed action will have no effect on the Gulf of Maine DPS of Atlantic salmon.

Oceanic White Tip Shark (Carcharhinus longimanus) – Threatened

The oceanic whitetip shark is usually found offshore in deep waters of the open ocean, on the outer continental shelf, or around oceanic islands in deep water greater than 184 m. As noted in Young et al. 2017, the species has a clear preference for open ocean waters between 10°N and 10°S, but can be found in decreasing numbers out to latitudes of 30°N and 35°S, with abundance decreasing with greater proximity to continental shelves. In the western Atlantic, oceanic whitetips occur from Maine to Argentina, including the Caribbean and Gulf of Mexico (Young et al. 2017). In the central and eastern Atlantic, the species occurs from Madeira, Portugal south to the Gulf of Guinea, and possibly in the Mediterranean Sea.

The WDA and the area where survey activities will occur is outside of the deep offshore areas where Oceanic whitetip sharks occur. The only portion of the action area that overlaps with their distribution is the open ocean waters of the U.S. EEZ that may be transited by vessels traveling to/from foreign ports and the vessel transit routes in the Gulf of Mexico. Vessel strikes are not identified as a threat in the status review (Young et al., 2017), listing determination (83 FR 4153) or the recovery outline (NMFS 2018). We have no information to suggest that vessels in the ocean have any effects on oceanic white tip sharks. Considering the lack of any reported vessel strikes, their swim speed and maneuverability (Papastamatiou et al. 2018), and the slow speed of ocean-going vessels, vessel strikes are not anticipated even if migrating individuals occur along the vessel transit routes. No effects from potential exposure to vessel noise are anticipated. The proposed action will have no effect on the oceanic white tip shark.

Gulf Sturgeon (Acipenser oxyrinchus desotoi) – Threatened

The Gulf sturgeon is a sub-species of the Atlantic sturgeon that can be found from Lake Pontchartrain and the Pearl River system in Louisiana and Mississippi to the Suwannee River in Florida (USFWS and NMFS 2009). Historically the species ranged from the Mississippi River east to Tampa Bay. Gulf sturgeon spawn in rivers in the spring and fall and spend the summer months between the upstream spawning areas and the estuary. In the winter, adults will move into marine waters but younger fish remain in the estuarine and freshwater habitats for their first few years.

The only portion of the action area that could potentially overlap with the range of Gulf sturgeon are the vessel transit routes in the Gulf of Mexico. The 71 vessels trips to/from the Gulf of Mexico during the approximately 7-year period that Project construction and/or installation vessels are anticipated to occur between the South Coast Wind WDA and ports in the western Gulf of Mexico (i.e., Tamaulipas, Mexico, Corpus Christi, Texas). The distribution of Gulf sturgeon within the Gulf of Mexico is limited to the northeastern areas of the Gulf. Vessels transiting between the WDA and ports in the Gulf of Mexico (i.e., Tamaulipas, Mexico, Corpus Christi, Texas) are not expected to transit the portion of the Gulf of Mexico where Gulf sturgeon occur. As such, we do not expect any effects on Gulf sturgeon caused by project vessels. The proposed action will have no effect on Gulf sturgeon.

Nassau Grouper (Epinephelus striatus) – Threatened

Nassau grouper are reef fish found in tropical and subtropical waters of the western North Atlantic. This includes Bermuda, Florida, Bahamas, the Yucatan Peninsula, and throughout the Caribbean to southern Brazil. There has been one verified report of Nassau grouper in the Gulf of Mexico at Flower Gardens Bank. They generally live among shallow reefs, but can be found in depths to 426 ft. (NMFS 2013). The range of Nassau grouper is described as including the southeastern portion of the Gulf of Mexico between the Florida coast and the Yucatan Peninsula (NMFS 2013). As described in NMFS 2013, the Nassau grouper is considered a reef fish, but it transitions through a series of ontogenetic shifts of both habitat and diet. As larvae, they are planktonic; as juveniles, they are found in nearshore shallow waters in macroalgal and seagrass habitats. They shift progressively deeper with increasing size and maturation into predominantly reef habitat (e.g., forereef and reef crest). Adult Nassau grouper tend to be relatively sedentary and are found most abundantly on high relief coral reefs or rocky substrate in clear waters (Sadovy and Eklund 1999 in NMFS 2013), although they can be found from the shoreline to about 100-130 m. Larger adults tend to occupy deeper, more rugose, reef areas (Semmens et al. 2007a in NMFS 2013).

Overlap with the range of Nassau grouper and the action area is limited to the portion of the action area where vessels transiting between the WDA and ports in the Gulf of Mexico (i.e., Tamaulipas, Mexico, Corpus Christi, Texas) would move through the southeastern portion of the Gulf of Mexico into the Atlantic Ocean. Given the primary distribution of Nassau grouper over reef habitats, which will be avoided by the transiting vessels, there is a low potential for occurrence of Nassau grouper in the areas where vessels will transit. Further, the near-bottom distribution of Nassau grouper in the water column makes interactions with any project vessels are not anticipated. Vessel strikes are not identified as a threat in the biological report that supported the listing determination (NMFS 2013), listing determination (81 FR 42268), or the recovery outline (NMFS 2018). We have no information to suggest that vessels in the ocean have any effects on Nassau grouper. Therefore, we do not expect any effects to this species even if individuals co-occur with project vessels. The proposed action will have no effect on Nassau grouper.

Smalltooth Sawfish (Pristis pectinate) – Endangered

Smalltooth sawfish live in shallow, coastal waters of tropical seas and estuaries of the Atlantic Ocean and sometimes enter the lower reaches of tropical freshwater river systems. The historical range for smalltooth sawfish in the western Atlantic extended from Brazil to the Gulf of Mexico and eastern seaboard of the U.S. (Carlson et al. 2013 in NMFS 2018). However, the species has been wholly or nearly extirpated from large areas of its historical range, and in U.S. waters smalltooth sawfish are now found only off the coast of Florida (NMFS 2018). Small, juvenile smalltooth sawfish are generally restricted to mangroves and estuaries around the Florida peninsula, where project vessels will not travel. Larger adults have a broader distribution and could be found in the southeastern Gulf of Mexico in nearshore waters along the Florida shoreline. Given the distribution of the species in nearshore waters, the occurrence of smalltooth sawfish along the deepwater areas that will be used by project vessels to transit between the WDA and ports in the Gulf of Mexico (i.e., Tamaulipas, Mexico, Corpus Christi, Texas) is extremely unlikely. Vessel strikes are not identified as a threat in the listing determination (68 FR 15674), the most-recent 5-year review (NMFS 2018), or the recovery plan (NMFS 2009). We have no information to suggest that vessels in the ocean have any effects on smalltooth sawfish. Therefore, we do not expect any effects to this species even if individuals unexpectedly occurred along the vessel transit routes to be traveled by project vessels. The proposed action will have no effect on smalltooth sawfish.

ESA Listed Corals – Threatened and Endangered
There are seven species of corals protected under the ESA that occur in the action area: Elkhorn coral (*Acropora palmata*); Staghorn coral (*Acropora cervicornis*); Boulder star coral (*Orbicella franksi*); Mountainous star coral (*Orbicella faveolata*); Lobed star coral (*Orbicella annularis*); Rough cactus coral (*Mycetophyllia ferox*); and Pillar coral (*Dendrogyra cylindrus*) (79 FR 53851). The only activity that overlaps with the distribution of these species includes the anticipated vessel transits between ports in the Gulf of Mexico and the WDA, including transit along the U.S. South Atlantic coast. Transit routes for project vessels may co-occur with coral habitats, however, no impacts to corals are anticipated along vessel transit routes as water depths exclude the potential for vessel hulls and propellers to interact with the sessile species, and no anchoring will occur in areas where corals could be present. No effects to any of these coral species are anticipated; the proposed action will have no effect on any species of ESA listed corals.

Giant Manta Ray (Mobula birostris) – Threatened
In January 2023 (88 FR 81351), the scientific name of the species was revised to from *Manta birostris* to *Mobula birostris*; no other changes to the species' status accompanied this name change. The giant manta ray inhabits temperate, tropical, and subtropical waters worldwide, primarily between 35° N and 35° S latitudes. In the western Atlantic Ocean, this includes waters off South Carolina south to Brazil and Bermuda. On the U.S. Atlantic coast, nearshore distribution is limited to areas off the Florida coast; otherwise, distribution occurs in offshore waters at the shelf edge. Occasionally, manta rays are observed as far north as Long Island (Miller and Klimovich 2017, Farmer et al. 2022); however, these sightings are in offshore waters along the continental shelf edge and the species is considered rare in waters north of Cape Hatteras. Distribution of Giant manta rays is limited by their thermal tolerance (19-22°C off the U.S. Atlantic coast) and influenced by depth. As noted by Farmer et al. (2022), cold winter air and sea surface temperatures in the western North Atlantic Ocean likely create a physiological barrier to manta rays that restricts the northern boundary of their distribution. Giant manta rays frequently feed in waters at depths of 656 to 1,312 ft. (200 to 400 m) (NMFS 2019a); the only portion of the action area with these depths is along the vessel transit routes south and east of the WDA. Based on the documented distribution of the species, Giant manta rays are not anticipated to occur in the WDA or in areas where surveys will occur. The only portion of the action area that overlaps with the distribution of Giant manta rays are the vessel transit routes south of Delaware Bay (i.e., to/from ports in Chesapeake Bay (Sparrows Point), South Carolina, and the Gulf of Mexico) and east of the lease area (i.e., within the U.S. EEZ where vessels travel across the continental shelf edge south of 40°N).

Here, we consider the potential for effects of project vessels. Giant manta rays can be frequently observed traveling just below the surface and will often approach or show little fear toward humans or vessels (Coles 1916), which may also make them vulnerable to vessel strikes (Deakos 2010); vessel strikes can injure or kill giant manta rays, decreasing fitness or contributing to non-natural mortality (Couturier et al. 2012; Deakos et al. 2011); however, vessel strikes are considered rare. Information about interactions between vessels and giant manta rays is limited. We have at least some reports of vessel strike, including a report of five giant manta rays struck by vessels from 2016 through 2018; individuals had injuries (i.e., fresh or healed dorsal surface propeller scars) consistent with a vessel strike. These interactions were observed by researchers conducting surveys from Boynton Beach to Jupiter, Florida (J. Pate, Florida Manta Project, pers. comm. to M. Miller, NMFS OPR, 2018) and it is unknown where the manta was at the time of the vessel strike. The geographic area considered to have the highest risk of vessel strikes for giant manta ray is nearshore coastal waters and inlets along the east coast of Florida where recreational vessel traffic is concentrated; this area does not overlap with the action area. Given the few instances of confirmed or suspected strandings of giant manta rays attributed to vessel strike injury, the risk of giant manta rays being struck by vessels is considered low. This lack of documented mortalities could also be the result of other factors that influence carcass detection (i.e., wind, currents, scavenging, decomposition etc.); however, giant manta rays appear to be able to be fast and agile enough to avoid most moving vessels, as anecdotally evidenced by videos showing rays avoiding interactions with high-speed vessels (Barnette 2018).

The speed and maneuverability of giant manta rays, the slow operating speed of project vessels transiting through the portion of the action area where Giant manta rays occur, and the dispersed nature of Giant manta ray distribution in the area where these vessels will operate, and the small number of potential vessel trips through the range of Giant manta rays (i.e., up to 71 trips to/from the Gulf of Mexico and up to 8 trips to/from Charleston, SC) make any effects of the proposed action extremely unlikely to occur. Since there will be no effects from potential exposure to vessel noise, and all other effects will be discountable, no take is anticipated and the proposed action is not likely to adversely affect the giant manta ray.

Hawksbill sea turtle (Eretmochelys imbricate) – Endangered

The hawksbill sea turtle is typically found in tropical and subtropical regions of the Atlantic, Pacific, and Indian Oceans, including the coral reef habitats of the Caribbean and Central America. Hawksbill turtles generally do not migrate north of Florida and their presence north of Florida is rare (NMFS and USFWS 1993).

Given their rarity in waters north of Florida, hawksbill sea turtles are not expected to occur in the WDA. The presence of hawksbill sea turtles in the action area is limited to the portion of the action area in the Gulf of Mexico and off the Florida coast that may be transited by project vessels. As noted in the BA, it is estimated that up to 71 vessel trips may be conducted between the Gulf of Mexico and the WDA during the five-year construction phase. Given the low number of trips during the five-year construction period (less than 15/year) and the dispersed nature of hawksbill sea turtles in the areas where vessels will transit, it is extremely unlikely that any hawksbill sea turtle will co-occur with project vessels. As such, effects to hawksbill sea turtles from vessel operations are extremely unlikely to occur and discountable. No take is anticipated. As all effects will be discountable, the proposed action is not likely to adversely affect the hawksbill sea turtle.

Rice's whale (Balaenoptera ricei) – Endangered

On August 23, 2021, NMFS issued a direct final rule to revise the common and scientific name of the Gulf of Mexico Bryde's whale to Rice's whale, *Balaneoptera ricei*, and classification to species to reflect the scientifically accepted taxonomy and nomenclature of the whales (86 FR 47022). The distribution of Rice's whale is limited to the northeastern Gulf of Mexico, along the continental shelf break between 100 m and 400 m depths (Rosel et al. 2016). The only project-related activity that has the potential to overlap with the species distribution are vessel transits between the WDA and ports in the Gulf of Mexico (i.e., Tamaulipas, Mexico, Corpus Christi, Texas). We have considered whether vessels transiting to and from the project area from ports in the Gulf of Mexico could potentially encounter Rice's whales. In the BA, BOEM estimates up to 71 vessel trips will be conducted between the Gulf of Mexico to the WDA during the five-year Project construction phase with any ports of origin in the Gulf of Mexico likely located west of the mouth of the Mississippi River (i.e., Corpus Christi, TX and Tamaulipas, Mex). As noted in the BA, project vessels will adhere to any current or future vessel strike avoidance guidelines for large whale conservation. The proposed action includes a number of measures for any project vessels operating in the Gulf of Mexico (see Table 3.3-1 in BOEM's BA and Appendix A of this Opinion). Based on the vessel transit routes, which are anticipated to be south and west of the distribution of Rice's whales, it is extremely unlikely that any Rice's whales will co-occur with project vessels; implementation of the vessel strike avoidance measures that are part of the proposed action further reduce the potential for any effects to Rice's whales. As such, any effects to Rice's whales are extremely unlikely to occur. No take is anticipated. As all effects will be discountable, the proposed action is not likely to adversely affect the Rice's whale.

Shortnose sturgeon (Acipenser brevirostrum) – Endangered
Shortnose sturgeon are benthic fish that mainly occupy the deep channel sections of large rivers (SSSRT 2010). Shortnose sturgeon do not occur in the lease area or along the cable corridor or in the area where surveys will occur. The only portion of the action area that overlaps with the distribution of shortnose sturgeon is a portion of the vessel transit route between the WDA and Sparrows Point, MD and a portion of the vessel transit route between the WDA and the Nexans cable facility in Charleston, SC. As noted in the BA, trips between the WDA and these two ports are limited to no more than eight vessel trips over the 5-year construction phase and up to two trips over the 30-year operations and maintenance phase.

Effects of Vessel Transits to the Nexans Facility at the Port of Charleston (SC)
In the May 4, 2020, Biological Opinion NMFS concluded that the construction and subsequent use of the Nexans Facility by any vessels was likely to adversely affect but not likely to jeopardize shortnose sturgeon. However, the only adverse effects to shortnose sturgeon were from dredging and riprap installation. In the Opinion, NMFS concluded that vessel strikes of shortnose sturgeon by vessels using the facility to transport cable were extremely unlikely to occur based on the frequency of vessel operations, type of vessel, and low transit speeds. In the Opinion, NMFS concluded that vessel use of the Nexans Facility was not likely to adversely affect shortnose sturgeon and, therefore, not likely to jeopardize the continued existence of shortnose sturgeon As the effects of this vessel traffic were already considered in the April 2020 Biological Opinion issued for the Nexans Facility, and no take of shortnose sturgeon by vessel strike was anticipated, and we do not anticipate any difference in the type or level of effects from vessel traffic from those considered in that opinion and no take is anticipated, SouthCoast's use of the Nexans Facility is also extremely unlikely to result in vessel strikes: the effects of vessel strike are thus discountable and not likely to adversely affect Shortnose sturgeon.

Effects of Vessel Transits to Sparrows Point

Vessels transiting to Baltimore/Sparrows Point may transit through Delaware Bay to the C&D canal or through the Chesapeake Bay north to the port. From the canal, these vessels would transit through the upper Chesapeake Bay to the Sparrows Point facility, located near the mouth of the Patapsco River.

Transient individual shortnose sturgeon are at least occasionally present in upper Chesapeake Bay; the best available information indicates that these are individuals that travel to the Bay from the C&D Canal (which connects the upper Bay to the Delaware River). Shortnose sturgeon are rare, infrequent visitors to the lower Chesapeake Bay. Shortnose sturgeon are not known to occur in the Patapsco River or at the Port of Baltimore. We have no reports of vessel strikes of shortnose sturgeon in this portion of the action area.

The Port of Baltimore typically has over 100 vessel arrivals and departures per day[10] and had approximately 3,000 inbound and 3,000 outbound commerce-carrying vessel trips in 2021 (USACE, 2021). The maximum 8 vessel trips over the 5-year construction period and 2 trips over the 30 year operations and maintenance period, represents up to approximately 0.13% of the annual commerce-carrying vessel traffic traveling through the Chesapeake Bay to the Port of Baltimore and a smaller percentage of the total vessel traffic in the Bay and at the Port (calculated with all 8 trips occurring in a single year, which is not expected). Given this extremely small increase increment of vessel traffic, and the lack of evidence of shortnose sturgeon being struck in this area, it is extremely unlikely that a SouthCoast vessel transiting to/from the Baltimore (Sparrows Point), Maryland will strike a shortnose sturgeon. As such, effects to shortnose sturgeon from project vessels operating in this portion of the action area are extremely unlikely to occur and are discountable: vessel transits to/from Sparrows Point caused by the proposed action are thus not likely to adversely affect Shortnose sturgeon

Chesapeake and Delaware Canal

The 14-mile long C&D canal is a fabricated waterway first excavated in 1824 to improve navigation time between ports in the Chesapeake Bay and the Delaware River; over time, it has been expanded and is currently maintained at a depth of 35 feet and width of 450 feet. Estimates of vessel traffic in the C&D canal include 25,000 total vessels annually[11] and a reported 5,853 commercial one-way trips in 2014 (USACE 2014).

Information on sturgeon use of the C&D canal is limited to detection of tagged individuals on telemetry receivers. Welsh *et al.* (2002) captured and tagged 13 shortnose sturgeon in the Chesapeake Bay and 26 in the Delaware River; receivers were deployed in upper Chesapeake Bay, in the C and D Canal and in the Delaware River. Two of the shortnose sturgeon tagged in Chesapeake Bay were detected on receivers within the canal; an additional shortnose sturgeon tagged in the Bay was later detected on receivers in the Delaware River. This third individual was assumed to swim through the canal during a three-week period when the receivers within the canal were not operational. More detailed information on use of the canal is provided in a final ESA Section 6 report prepared by the State of Delaware (Award Number NAI0NMF4720030).

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[10] https://www.marinetraffic.com/en/ais/details/ports/95?name=BALTIMORE&country=USA#Statistics; last accessed June 4, 2024

[11] http://www.offshoreblue.com/cruising/cd-canal.php

As part of a study to document interbasin movements through the canal, an array of five receivers was deployed from April through November in 2011, 2012, and 2013. In all three years, a small number of tagged shortnose sturgeon (0-1 shortnose annually) were documented in the canal. In all cases, the movements were characterized as exploratory behavior lasting from two hours to two weeks.

We have reports of five dead Atlantic sturgeon that were observed within the canal (one in 2013, three in 2016, and one in 2020). Three of these had injuries consistent with vessel strike (2 in 2016, 1 in 2020); the other two were too decomposed to assess injuries or any potential cause of mortality. For purposes of this consultation, we are assuming that the three sturgeon with identifiable injuries were struck and killed within the canal. We have no other information on vessel strikes in the C&D canal; however, even this limited information indicates that there is a risk of vessel strike in the C&D canal. There are no targeted surveys to monitor sturgeon in the canal or to look for dead sturgeon in this area. All reports received were opportunistic reports.

We have considered whether the increase in vessel traffic that will result from the use of the C&D canal would increase vessel strikes of shortnose sturgeon. Given the high amount of vessel traffic in the waterbody, and even just considering the number of commercial one way trips (5,853), even if all 8 potential trips during the construction period occurred in a single year, this would result in an approximately 0.13% increase in vessel traffic The actual percent increase in vessel traffic is likely even less considering that commercial traffic is only a portion of the vessel traffic in the canal (e.g., if the 25,000 vessel estimate is used the increase in traffic would represent a 0.0002% increase). The highest number of sturgeon mortalities observed in the canal in a single year is the two in 2016. As noted above, in 2016 two dead Atlantic sturgeon were observed in the canal with injuries consistent with vessel strike. If we assume that the increase in vessel traffic will result in a corresponding increase in risk of vessel strike and number of sturgeon struck, and that the risk to shortnose sturgeon is no greater than Atlantic sturgeon we would expect an additional 0.0006 shortnose sturgeon struck in the canal. Given this very small increase in traffic and the similar very small potential increase in risk of strike and a calculated potential increase in the number of strikes that is very close to zero (despite likely being an overestimate), we have determined that vessel strike of a shortnose sturgeon from a SouthCoast vessel transiting the C&D Canal is extremely unlikely to occur and effects are discountable: the effects caused by the increase in vessel traffic in the Chesapeake and Delaware Canal from the proposed action are thus not likely to adversely affect Shortnose sturgeon.

Transits through the Delaware River/Delaware Bay

As noted above, the 10 total vessel trips that may occur between the WDA and Sparrows Point (8 during the construction period and 2 during operations) may travel through the Delaware River and C&D Canal. Shortnose sturgeon are known to be struck and killed by vessels operating in the Delaware River. In 2014, there were 42,398 one-way trips reported for commercial vessels in the Delaware River Federal navigation channel (USACE 2014). In 2020, 2,195 cargo ships visited Delaware River ports[12]. Neither of these numbers includes any recreational or other non-commercial vessels, ferries, tugboats assisting other larger vessels or any Department of Defense vessels (i.e., Navy, USCG, etc.).

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[12] https://ajot.com/news/maritime-exchange-reports-2020-ship-arrivals; last accessed March 24, 2021

If we assume that any increase in vessel traffic in the Delaware River would increase the risk of vessel strike to shortnose sturgeon, then we could also assume that this would result in a corresponding increase in the number of sturgeon struck and killed in the Delaware River. Considering only the number of commercial one way trips in a representative year (42,398), and even assuming that 8 SouthCoast vessel transits occurred in a single year, this represents an approximately 0.019% increase in vessel traffic in the Delaware River navigation channel in a given year. The actual percent increase in vessel traffic is likely even less considering that commercial traffic is only a portion of the vessel traffic in the river. DiJohnson (2019) estimates that approximately 400 Atlantic sturgeon have been killed by vessel strikes in the Delaware River from 2005 – 2019, resulting in an average annual mortality of approximately 27 individuals. Even in a worst-case scenario that assumes that an equal number of shortnose sturgeon are killed annually and that all 27 mortalities occur in the portion of the Delaware River that will be transited by the survey vessels, and that any increase in vessel traffic due to the project results in a proportionate increase in vessel strikes, this increase in vessel traffic would result in a hypothetical additional 0.002 shortnose sturgeon struck and killed in the Delaware River. Given this very small increase in traffic and the similar very small potential increase in risk of strike and a calculated potential increase in the number of strikes that is very close to zero (despite likely being an overestimate) we conclude that any increase in the number of sturgeon struck in this reach because of the increase in traffic resulting from the SouthCoast project operating through Delaware Bay to the C&D canal to use the Sparrows Point Port is extremely unlikely. Therefore, effects of this increase in traffic are extremely unlikely and effects are discountable: the effects caused by the increase in vessel traffic in the Delaware River/Delaware Bay from the proposed action are thus not likely to adversely affect Shortnose sturgeon.

4.2 Critical Habitat

Critical Habitat Designated for North Atlantic right whales

On January 27, 2016, NMFS issued a final rule designating critical habitat for North Atlantic right whales (81 FR 4837). Critical habitat includes two areas (Units) located in the Gulf of Maine and Georges Bank Region (Unit 1) and off the coast of North Carolina, South Carolina, Georgia and Florida (Unit 2). Some vessels traveling from ports in Massachusetts (Salem) and/or Canada may transit through portions of Unit 1 while within the U.S. EEZ. No other effects of the project will extend to Unit 1. Additionally, vessels transiting to/from ports in the Gulf of Mexico or Charleston, SC may transit through Unit 2. No other effects of the project will extend to Unit 1 or Unit 2.

Consideration of Potential Effects to Unit 1

As identified in the final rule (81 FR 4837), the physical and biological features essential to the conservation of the North Atlantic right whale that provide foraging area functions in Unit 1 are: The physical oceanographic conditions and structures of the Gulf of Maine and Georges Bank region that combine to distribute and aggregate *C. finmarchicus* for right whale foraging, namely prevailing currents and circulation patterns, bathymetric features (basins, banks, and channels), oceanic fronts, density gradients, and temperature regimes; low flow velocities in Jordan, Wilkinson, and Georges Basins that allow diapausing *C. finmarchicus* to aggregate passively below the convective layer so that the copepods are retained in the basins; late stage *C.*

finmarchicus in dense aggregations in the Gulf of Maine and Georges Bank region; and diapausing *C. finmarchicus* in aggregations in the Gulf of Maine and Georges Bank region. Outside of potential vessel transits, there are no project activities that overlap with Unit 1. Vessel transits that may occur within Unit 1 will have no effect on any of the physical or biological features of critical habitat. Here, we explain our consideration of whether any project activities located outside of Unit 1 may affect Unit 1.

We have considered whether the proposed action would have any effects to right whale critical habitat. Copepods in critical habitat originate from Jordan, Wilkinson, and George's Basin. The effects of the proposed action, including those of vessels going to/from Canada, do not extend to these areas, and we do not expect any effects to the generation of copepods in these areas that could be attributable to the proposed action. The proposed action will also not affect any of the physical or oceanographic conditions that serve to aggregate copepods in critical habitat. Offshore wind farms can reduce wind speed and wind stress which can lead to less mixing, lower current speeds, and higher surface water temperature (Afsharian et al. 2019), cause wakes that will result in detectable changes in vertical motion and/or structure in the water column (e.g. Christiansen & Hasager 2005, Broström 2008), as well as detectable wakes downstream from a wind farm by increased turbidity (Vanhellemont and Ruddick, 2014). However, there is no information to suggest that effects from the South Coast Wind project would extend to Unit 1 of right whale critical habitat. The SouthCoast Wind project is a significant distance from right whale critical habitat and, thus, it is not anticipated to affect the oceanographic features of that critical habitat. Further, the South Coast Wind project is not anticipated to cause changes to the physical or biological features of critical habitat by worsening climate change. Therefore, we have determined that the proposed action will have no effect on Unit 1 of right whale critical habitat.

Consideration of Potential Effects to Unit 2
As identified in the final rule (81 FR 4837), the physical and biological features essential to the conservation of the North Atlantic right whale, which provide calving area functions in Unit 2, are: (i) Sea surface conditions associated with Force 4 or less on the Beaufort Scale; (ii) Sea surface temperatures of 7 °C to 17 °C; and, (iii) Water depths of 6 to 28 m, where these features simultaneously co-occur over contiguous areas of at least 231 nmi^2 of ocean waters during the months of November through April. When these features are available, they are selected by right whale cows and calves in dynamic combinations that are suitable for calving, nursing, and rearing, and which vary, within the ranges specified, depending on factors such as weather and age of the calves. Vessel transits will have no effect on the features of Unit 2; this is because vessel operations do not affect sea surface state, water temperature, or water depth. Therefore, we have determined that the proposed action will have no effect on Unit 2 of right whale critical habitat.

Summary of Effects to Right Whale Critical Habitat
We have determined that because the proposed action will have no effect on any of the PBFs, the proposed action will have no effect on the critical habitat designated for North Atlantic right whales.

Critical Habitat for the Northwest Atlantic Ocean DPS of Loggerhead Sea Turtles

Critical habitat for the Northwest Atlantic Ocean DPS of loggerhead sea turtles was designated in 2014 (79 FR 39855). Specific areas for designation include 38 occupied marine areas within the range of the Northwest Atlantic Ocean DPS. These areas contain one or a combination of habitat types: Nearshore reproductive habitat, winter area, breeding areas, constricted migratory corridors, and/or Sargassum habitat. There is no critical habitat designated in the WDA. The only project activities that may overlap with Northwest Atlantic loggerhead DPS critical habitat are vessels transiting to or from the project site from ports outside the Northeast U.S. (i.e. the Gulf of Mexico and Charleston, SC). As explained below, the proposed action will have no effect on this critical habitat.

Nearshore Reproductive
The PBF of nearshore reproductive habitat is described as a portion of the nearshore waters adjacent to nesting beaches that are used by hatchlings to egress to the open-water environment as well as by nesting females to transit between beach and open water during the nesting season. Primary Constituent Elements (PCEs) that support this habitat are the following: (1) Nearshore waters directly off the highest density nesting beaches and their adjacent beaches as identified in 50 CFR 17.95(c) to 1.6 km (1 mile) offshore; (2) Waters sufficiently free of obstructions or artificial lighting to allow transit through the surf zone and outward toward open water; and, (3) Waters with minimal manmade structures that could promote predators (i.e., nearshore predator concentration caused by submerged and emergent offshore structures), disrupt wave patterns necessary for orientation, and/or create excessive longshore currents.

The occasional project vessel transits that may occur within the designated nearshore reproductive habitat will have no effect on nearshore reproductive habitat for the following reasons: waters would remain free of obstructions or artificial lighting that would affect the transit of turtles through the surf zone and outward toward open water; and, vessel transits would not promote predators or disrupt wave patterns necessary for orientation or create excessive longshore currents.

Winter
The PBF of winter habitat is described as warm water habitat south of Cape Hatteras, North Carolina near the western edge of the Gulf Stream used by a high concentration of juveniles and adults during the winter months. PCEs that support this habitat are the following: (1) Water temperatures above 10° C from November through April; (2) Continental shelf waters in proximity to the western boundary of the Gulf Stream; and, (3) Water depths between 20 and 100 m.

The occasional project vessel transits that may occur within the designated winter habitat will have no effect on this habitat because they will not: affect or change water temperatures above 10° C from November through April; affect habitat in continental shelf waters in proximity to the western boundary of the Gulf Stream; or, affect or change water depths between 20 and 100 m.

Breeding
The PBFs of concentrated breeding habitat are sites with high densities of both male and female adult individuals during the breeding season. PCEs that support this habitat are the following:

(1) High densities of reproductive male and female loggerheads; (2) Proximity to primary Florida migratory corridor; and, (3) Proximity to Florida nesting grounds.

The occasional project vessel transits that may occur within the designated breeding habitat will have no effect on this habitat because they will not: affect the density of reproductive male or female loggerheads or result in any alterations of habitat in proximity to the primary Florida migratory corridor or Florida nesting grounds.

Constricted Migratory Corridors
The PBF of constricted migratory habitat is high use migratory corridors that are constricted (limited in width) by land on one side and the edge of the continental shelf and Gulf Stream on the other side. PCEs that support this habitat are the following: (1) Constricted continental shelf area relative to nearby continental shelf waters that concentrate migratory pathways; and, (2) Passage conditions to allow for migration to and from nesting, breeding, and/or foraging areas. The occasional project vessel transits that may occur within the designated winter habitat will have no effect on this habitat because they will not result in any alterations of habitat in the constricted continental shelf area and will not affect passage conditions in this area.

Sargassum
The PBF of loggerhead *Sargassum* habitat is developmental and foraging habitat for young loggerheads where surface waters form accumulations of floating material, especially Sargassum. PCEs that support this habitat are the following: (i) Convergence zones, surface-water downwelling areas, the margins of major boundary currents (Gulf Stream), and other locations where there are concentrated components of the Sargassum community in water temperatures suitable for the optimal growth of Sargassum and inhabitance of loggerheads; (ii) Sargassum in concentrations that support adequate prey abundance and cover; (iii) Available prey and other material associated with Sargassum habitat including, but not limited to, plants and cyanobacteria and animals native to the Sargassum community such as hydroids and copepods; and, (iv) Sufficient water depth and proximity to available currents to ensure offshore transport (out of the surf zone), and foraging and cover requirements by Sargassum for post-hatchling loggerheads, i.e., >10 m depth.

The occasional project vessel transits that may occur within the designated *Sargassum* habitat will have no effect on: conditions that result in convergence zones, surface-water downwelling areas, the margins of major boundary currents (Gulf Stream), and other locations where there are concentrated components of the Sargassum community in water temperatures suitable for the optimal growth of Sargassum and inhabitance of loggerheads; the concentration of Sargassum; the availability of prey within Sargassum; or the depth of water in any area.

Summary of Effects to Critical Habitat
We have determined that because the proposed action will have no effect on any of the PBFs, the proposed action will have no effect on the critical habitat designated for the Northwest Atlantic DPS of loggerhead sea turtles.

Critical Habitat for Elkhorn (Acropora palmate) and Staghorn (A. cervicornis) Corals

NMFS designated critical habitat for elkhorn and staghorn corals includes four specific areas: the Florida area, the Puerto Rico area, the St. John/St. Thomas area, and the St. Croix area (73 FR 72210, November 26, 2008. The Florida area encompasses approximately 1,329 square miles (3,442 square kilometers) of marine habitat and is within the action area; however, vessels transiting between the WDA and ports in the Gulf of Mexico (i.e., Tamaulipas, Mexico, Corpus Christi, Texas) are not expected to transit through the area designated as critical habitat due to its shallow depths (i.e., critical habitat extends out to depths of 30 m). As described in the final listing rule, the physical and biological feature (PBF) essential to conservation of these species is substrate of suitable quality and availability (i.e., natural consolidated hard substrate or dead coral skeleton that is free from fleshy or turf macroalgae cover and sediment cover) to support successful larval settlement and recruitment, and reattachment and recruitment of fragments. Even if project vessels did transit through areas designated as critical habitat, these vessel transits would not affect this PBF as no substrate-disturbing activities (e.g., anchoring) are expected in this portion of the action area. No effects to this critical habitat are anticipated because of the proposed action.

Critical Habitat Designated for Atlantic sturgeon

Critical habitat has been designated for all five DPSs of Atlantic sturgeon (82 FR 39160; effective date September 18, 2017). The action area overlaps with a portion of the Delaware River critical habitat unit designated for the New York Bight DPS and a portion of the Cooper River critical habitat unit designated for the Carolina DPS. Vessel transits that may occur in the Chesapeake Bay (i.e., to/from Sparrows Point) would not overlap with any critical habitat designated for the Chesapeake Bay DPS of Atlantic sturgeon.

Critical Habitat Designated for the Carolina DPS of Atlantic sturgeon

The critical habitat designation for the Carolina DPS is for habitats that support successful Atlantic sturgeon reproduction and recruitment. Carolina Unit 7 includes the Santee River (below the Wilson Dam), the Rediversion Canal (below the St. Stephens Dam), the North Santee River, the South Santee River, and Tailrae Canal – West Branch Cooper River (below Pinopolis Dam) and the mainstem Cooper River. The only project activity that might overlap with critical habitat designation for the Carolina DPS of Atlantic sturgeon are vessels transiting to the Port of Charleston in South Carolina, which is located near the mouth of the Cooper River.
On May 4, 2020, NMFS Southeast Regional Office issued a Biological Opinion to the USACE on the effects of construction and operation of the Nexans Cable Facility (SERO 2020). The subsea cable plant is located along the Cooper River in Charleston, South Carolina, within Unit 7 of the critical habitat designated for the Carolina DPS.

In the 2020 Nexans Biological Opinion, NMFS concluded that the construction and use by vessels of the Nexans Facility was likely to adversely affect but not likely to destroy or adversely modify critical habitat designated for the Carolina DPS of Atlantic sturgeon (SERO 2020). As explained in the 2020 Nexans Biological Opinion, NMFS determined that there would be temporary and permanent effects to the critical habitat in the Copper River as a result of dredging and riprap associated with the construction of the facility. No effects of vessel use on critical habitat were anticipated in the Opinion and we do not expect any will occur as a result of the South Coast Wind project vessel’s use of the Port of Charleston in South Carolina.

Critical Habitat Designated for the New York Bight DPS of Atlantic sturgeon
The only project activity that may affect the Delaware River critical habitat unit is the transit of project vessels to or from Sparrows Point that transit through the Delaware River to/from the C&D Canal.

The critical habitat designation for the New York Bight DPS is for habitats that support successful Atlantic sturgeon reproduction and recruitment. The Delaware River critical habitat unit extends from the crossing of the Trenton-Morrisville Route 1 Toll Bridge, downstream to where the main stem river discharges at its mouth into Delaware Bay. In order to determine if the proposed action may affect critical habitat, we consider whether it would impact the habitat in a way that would affect its ability to support reproduction and recruitment. Specifically, we consider the effects of the action on the physical features of the critical habitat. The essential features identified in the final rule are:

> (1) Hard bottom substrate (e.g., rock, cobble, gravel, limestone, boulder, etc.) in low salinity waters (i.e., 0.0 to 0.5 parts per thousand (ppt) range) for settlement of fertilized eggs, refuge, growth, and development of early life stages;
>
> (2) Aquatic habitat with a gradual downstream salinity gradient of 0.5 up to as high as 30 ppt and soft substrate (e.g., sand, mud) between the river mouth and spawning sites for juvenile foraging and physiological development;
>
> (3) Water of appropriate depth and absent physical barriers to passage (e.g., locks, dams, thermal plumes, turbidity, sound, reservoirs, gear, etc.) between the river mouth and spawning sites necessary to support: (i) Unimpeded movement of adults to and from spawning sites; (ii) Seasonal and physiologically dependent movement of juvenile Atlantic sturgeon to appropriate salinity zones within the river estuary; and, (iii) Staging, resting, or holding of subadults or spawning condition adults. Water depths in main river channels must also be deep enough (e.g., at least 1.2 m) to ensure continuous flow in the main channel at all times when any sturgeon life stage would be in the river.
>
> (4) Water, between the river mouth and spawning sites, especially in the bottom meter of the water column, with the temperature, salinity, and oxygen values that, combined, support: (i) Spawning; (ii) Annual and interannual adult, subadult, larval, and juvenile survival; and, (iii) Larval, juvenile, and subadult growth, development, and recruitment (e.g., 13°C to 26 °C for spawning habitat and no more than 30°C for juvenile rearing habitat, and 6 milligrams per liter (mg/L) dissolved oxygen (DO) or greater for juvenile rearing habitat).

Each critical habitat unit contains all four of the physical features (referred to as physical or biological features (PBF)); however, only PBFs 2, 3, and 4 occur in the action area. In the Delaware River, the area upstream of RKM 122 is considered to have the salinity levels consistent with the requirements of PBF 1. Here, we consider effects of vessel transits on PBFs 2, 3, and 4.

In considering effects to PBF 2, we consider whether the proposed action will have any effect on areas of soft substrate within transitional salinity zones between the river mouth and spawning sites for juvenile foraging and physiological development; therefore, we consider effects of the action on soft substrate and salinity and any change in the value of this feature in the action area. Project vessels will have no effect on this feature as they will not have any effect on salinity, and they will not interact with the river bottom in this reach of the river.

In considering effects to PBF 3, we consider whether the proposed action will have any effect on water of appropriate depth and absent physical barriers to passage (e.g., locks, dams, thermal plumes, turbidity, sound, reservoirs, gear, etc.) between the river mouth and spawning sites necessary to support: unimpeded movements of adults to and from spawning sites; seasonal and physiologically dependent movement of juvenile Atlantic sturgeon to appropriate salinity zones within the river estuary, and; staging, resting, or holding of subadults or spawning condition adults. We also consider whether the proposed action will affect water depth or water flow, given water that is too shallow can be a barrier to sturgeon movements, and an alteration in water flow could similarly impact the movements of sturgeon in the river, particularly early life stages that are dependent on downstream drift. Therefore, we consider effects of the action on water depth and water flow and whether the action results in barriers to passage that impede the movements of Atlantic sturgeon. Project vessels will have no effect on this feature as they will not have any effect on water depth or water flow and will not be physical barriers to passage for any life stage of Atlantic sturgeon that may occur in this portion of the action area. Therefore, there will be no effect on PBF 3.

In considering effects to PBF 4, we consider whether the proposed action will have any effect on water, between the river mouth and spawning sites, especially in the bottom meter of the water column, with the temperature, salinity, and oxygen values that, combined, support: spawning; annual and interannual adult, subadult, larval, and juvenile survival; and larval, juvenile, and subadult growth, development, and recruitment. Therefore, we consider effects of the action on temperature, salinity and dissolved oxygen needs for Atlantic sturgeon spawning and recruitment. These water quality conditions are interactive and both temperature and salinity influence the dissolved oxygen saturation for a particular area. We also consider whether the action will have effects to access to this feature, temporarily or permanently and consider the effect of the action on the action area's ability to develop the feature over time. Project vessels will have no effect on this feature as they will not have any effect on temperature, salinity or dissolved oxygen.

Summary of Effects to Atlantic Sturgeon (New York Bight DPS) Critical Habitat
We have determined that the proposed action will have no effect on the Delaware River critical habitat unit.

Critical Habitat in the Gulf of Mexico – Gulf Sturgeon and Smalltooth Sawfish
Critical Habitat currently designated within the U.S. Gulf of Mexico includes: (1) Gulf Sturgeon (*Acipenser oxyrinchus desotoi*) critical habitat (68 FR 13370) which comprises 14 geographic areas including freshwater rivers and tributaries and nearshore marine and estuarine habitats between the mouth of the Mississippi to the Suwanee River in Florida; and (2) smalltooth sawfish (*Pristis ectinatea*) critical habitat designated in 2 coastal areas of south Florida in the Charlotte Harbor Estuary and the Ten Thousand Islands/Everglades (74 FR 45353).

The only proposed activity that would occur in the Gulf of Mexico would be vessel transits. No anchoring or other activities that could disturb the seafloor would occur as part of the action within the designated critical habitats in the Gulf of Mexico. Both Gulf sturgeon and smalltooth sawfish critical habitats are close to the coast in shallow waters, and vessel transit for large offshore wind support vessels would not be expected to traverse these areas. No effects of vessel transits on this critical habitat are expected. The proposed action will have no effect on critical habitat designated for Gulf sturgeon or smalltooth sawfish.

Critical Habitat for Nassau Grouper

Critical habitat for Nassau grouper (*Epinephelus striatus*) was designated on January 2, 2024 and became effective on February 1, 2024 (89 FR 126). The designated areas include habitat features that are essential to the conservation of Nassau grouper, including areas for spawning, recruitment, and development. The final designation includes 20 different geographic units and contain approximately 920.73 square miles (2,385.67 square kilometers) of aquatic habitat located in waters off the coasts of southeastern Florida and the Florida Keys, Puerto Rico, Navassa, and the U.S. Virgin Islands.

Within the habitats used by Nassau grouper as they progress through their life history stages, the following essential features have been identified (NMFS, 2023q):

- Recruitment and developmental habitat: Areas from nearshore to offshore necessary for recruitment, development, and growth of Nassau grouper containing a variety of benthic types that provide cover from predators and habitat for prey, consisting of the following:

- Nearshore shallow subtidal marine nursery areas with substrate that consists of unconsolidated calcareous medium to very coarse sediments (not fine sand) and shell and coral fragments and may also include cobble, boulders, whole corals and shells, or rubble mounds, to support larval settlement and provide shelter from predators during growth and habitat for prey.

- Intermediate hardbottom and seagrass areas in close proximity to the nearshore shallow subtidal marine nursery areas that provide refuge and prey resources for juvenile fish. The areas include seagrass interspersed with areas of rubble, boulders, shell fragments, or other forms of cover; inshore patch and fore reefs that provide crevices and holes; or substrates interspersed with scattered sponges, octocorals, rock and macroalgal patches, or stony corals.

- Offshore linear and patch reefs in close proximity to intermediate hardbottom and seagrass areas that contain multiple benthic types; for example: coral reef, colonized hardbottom, sponge habitat, coral rubble, rocky outcrops, or ledges, to provide shelter from predation during maturation and habitat for prey.

- Structures between the subtidal nearshore area and the intermediate hardbottom and seagrass area and the offshore reef area including overhangs, crevices, depressions, blowout ledges, holes, and other types of formations of varying sizes and complexity to support juveniles and adults as movement corridors that include temporary refuge that reduces predation risk as Nassau grouper move from nearshore to offshore habitats.

- Spawning Habitat: Marine sites used for spawning and adjacent waters that support movement and staging associated with spawning.

The only potential Project activities that might occur in Nassau grouper critical habitat would be vessel transits from the Panama Canal through the Caribbean Sea and Southeast U.S. waters. Such vessel transits are estimated at fewer than ten trips over the entire life of the Project. Most Nassau grouper critical habitat is designated in nearshore waters that are unlikely to be transited by Project vessels. Even if project vessels transited through areas designated as critical habitat for Nassau Grouper, no effects to any of the physical or biological features of the critical habitat are expected to result from vessel transits. Therefore, there will be no effects of vessel transits on critical habitat.

5.0 STATUS OF THE SPECIES

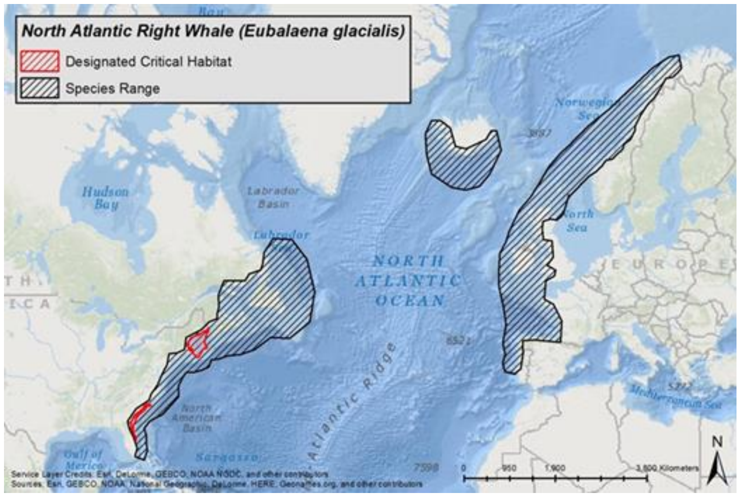
5.1 Marine Mammals

5.1.1 North Atlantic Right Whale (Eubalaena glacialis)

There are three species classified as right whales (genus *Eubalaena*): North Pacific (*E. japonica*), Southern (*E. australis*), and North Atlantic (*E. glacialis*). The North Atlantic right whale is the only species of right whale that occurs in the North Atlantic Ocean (Figure 5.1.1) and, therefore, is the only species of right whale that may occur in the action area.

North Atlantic right whales occur primarily in the western North Atlantic Ocean. However, there have been acoustic detections, reports, and/or sightings of North Atlantic right whales in waters off Greenland (east/southeast), Newfoundland, northern Norway, and Iceland, as well as within Labrador Basin (Hamilton et al. 1998, Jacobsen et al. 2004, Knowlton et al. 1992, Mellinger et al. 2011). These latter sightings/detections are consistent with historic records documenting North Atlantic right whales south of Greenland, in the Denmark straits, and in eastern North Atlantic waters (Kraus et al. 2007). There is also evidence of possible historic North Atlantic right whale calving grounds in the Mediterranean Sea (Rodrigues et al. 2018), an area not currently considered as part of this species' historical range.

Figure 5.1.1. Approximate historic range and currently designated U.S. critical habitat of the North Atlantic right whale



The North Atlantic right whale is distinguished by its stocky body and lack of a dorsal fin. The species was listed as endangered on December 2, 1970. We used information available in the most recent five-year review for North Atlantic right whales (NMFS 2022), the most recent stock assessment reports (Hayes et al. 2022, Hayes et al. 2023, and Hayes et al. 2024 DRAFT), and the available scientific literature cited herein to summarize the status of the species, as follows.

Life History

The maximum lifespan of North Atlantic right whales is unknown, but one individual reached at least 70 years of age (Hamilton et al. 1998, Kenney 2009). Previous modeling efforts suggest that in 1980, females had a life expectancy of approximately 51.8 years of age, which was twice that of males at the time (Fujiwara and Caswell 2001); however, by 1995, female life expectancy was estimated to have declined to approximately 14.5 years (Fujiwara and Caswell 2001). Most recent estimates indicate that North Atlantic right whale females are only living to 45 and males to age 65 (https://www.fisheries.noaa.gov/species/north-atlantic-right-whale). Females, ages 5+, have reduced survival relative to males, ages 5+, resulting in a decrease in female abundance relative to male abundance (Pace et al. 2017). Specifically, state-space mark-recapture model estimates show that from 2010-2015, males declined just under 4.0%, and females declined approximately 7% (Pace et al. 2017).

Gestation is estimated to be between 12 and 14 months, after which calves typically nurse for around one year (Cole et al. 2013, Kenney 2009, Kraus and Hatch 2001, Lockyer 1984). After weaning a calf, females typically undergo a ‘resting’ period before becoming pregnant again, presumably because they need time to recover from the energy deficit experienced during lactation (Fortune et al. 2013, Fortune et al. 2012, Pettis et al. 2017). From 1983 to 2005, annual average calving intervals ranged from 3 to 5.8 years (overall average of 4.23 years) (Kraus et al. 2007). Between 2006 and 2015, annual average calving intervals continued to vary within this range, but in 2016 and 2017 longer calving intervals were reported (6.3 to 6.6 years in 2016 and 10.2 years in 2017) (Hayes et al. 2018a, Pettis and Hamilton 2015, Pettis and Hamilton 2016, Pettis et al. 2018a, Pettis et al. 2018b, Pettis et al. 2020). There were no calves recorded in 2018.

Annual average calving interval between 2019 and 2023 ranged from a low of 7 in 2019 to a high of 9.2 in 2021 (Pettis and Hamilton 2023).

The calving index is the annual percentage of reproductive females assumed alive and available to calve that was observed to produce a calf. This index averaged 47% from 2003 to 2010; from 2009 through 2023, the percentage of available females that had calves ranged from 0% (2018) to 44.9% (2011) and has ranged from 25-26.8% from 2021-2023 (Pettis and Hamilton 2023). Females have been known to give birth as young as five years old, but the mean age of a female first giving birth is 10.2 years old (n=76, range 5 to 23, SD 3.3) (Moore et al. 2021). Taken together, changes to inter-birth interval and age to first reproduction suggest that both parous (having given birth) and nulliparous (not having given birth) females are experiencing delays in calving. These calving delays correspond with the recent distribution shifts. The low reproductive rate of right whales is likely the result of several factors including nutrition (Fortune et al. 2013, Moore et al. 2021). Evidence also indicates that North Atlantic right whales are growing to shorter adult lengths than in earlier decades (Stewart et al. 2021) and are in poor body condition compared to southern right whales (Christiansen et al. 2020). As stated in Hayes et al. 2023, all these changes may result from a combination of documented regime shifts in primary feeding habitats (Meyer-Gutbrod and Greene 2014; Meyer-Gutbrod et al. 2021; Record et al. 2019), and increased energy expenditures related to non-lethal entanglements (Rolland et al. 2016; Pettis et al. 2017b; van der Hoop 2017). As noted in the 2022 Five-Year Review (NMFS 2022), poor body condition, arrested growth, and maternal body length have led to reduced reproductive success and are contributors to low birth rates for the population over the past decade (Christiansen et al. 2020; Reed et al. 2022; Stewart et al. 2021; Stewart et al. 2022).

Pregnant North Atlantic right whales migrate south, through the mid-Atlantic region of the U.S., to low latitudes during late fall where they overwinter and give birth in shallow, coastal waters (Kenney 2009, Krzystan et al. 2018). During spring, these females and new calves migrate to high latitude foraging grounds where they feed on large concentrations of copepods, primarily *C. finmarchicus* (Mayo et al. 2018, NMFS 2017). Some non-reproductive North Atlantic right whales (males, juveniles, non-reproducing females) also migrate south, although at more variable times throughout the winter. Others appear to not migrate south and remain in the northern feeding grounds year round or go elsewhere (Bort et al. 2015, Mayo et al. 2018, Morano et al. 2012, NMFS 2017, Stone et al. 2017). Nonetheless, calving females arrive to the southern calving grounds earlier and stay in the area more than twice as long as other demographics (Krzystan et al. 2018). Little is known about North Atlantic right whale habitat use in the mid-Atlantic, but recent acoustic data indicate near year round presence of at least some whales off the coasts of New Jersey, Virginia, and North Carolina (Davis et al. 2017, Hodge et al. 2015, Salisbury et al. 2016, Whitt et al. 2013). While it is generally not known where North Atlantic right whales mate, some evidence suggests that mating may occur in the northern feeding grounds (Cole et al. 2013, Matthews et al. 2014).

Population Dynamics
Today, North Atlantic right whales are primarily found in the western North Atlantic, from their calving grounds in lower latitudes off the coast of the southeastern United States to their feeding grounds in higher latitudes off the coast of New England and Nova Scotia (Hayes et al. 2018a). Beginning in 2010, a change in seasonal residency patterns has been documented through visual

and acoustic monitoring with declines in presence in the Bay of Fundy, Gulf of Maine, and Great South Channel, and more animals being observed in Cape Cod Bay, the Gulf of Saint Lawrence, the mid-Atlantic, and south of Nantucket, Massachusetts (Daoust et al. 2018, Davies et al. 2019, Davis et al. 2017, Hayes et al. 2018a, Hayes et al. 2019, Meyer-Gutbrod et al. 2018, Moore et al. 2021, Pace et al. 2017, Quintana-Rizzo et al. 2021). Right whales have been observed nearly year round in the area south of Martha's Vineyard and Nantucket, with highest sightings rates between December and May (Leiter et al., 2017, Stone et al. 2017, Quintana-Rizzo et al. 2021, O'Brien et al. 2022). Increased detections of right whales in the Gulf of St. Lawrence have been documented from late spring through the fall (Cole et al. 2016, Simard et al. 2019, DFO 2020).

There are two recognized populations of North Atlantic right whales, an eastern, and a western population. Very few individuals likely make up the population in the eastern Atlantic, which is thought to be functionally extinct (Best et al. 2001). However, in recent years, a few known individuals from the western population have been seen in the eastern Atlantic, suggesting some individuals may have wider ranges than previously thought (Kenney 2009). Specifically, there have been acoustic detections, reports, and/or sightings of North Atlantic right whales in waters off Greenland (east/southeast), Newfoundland, northern Norway, and Iceland, as well as within Labrador Basin (Jacobsen et al. 2004, Knowlton et al. 1992, Mellinger et al. 2011). It is estimated that the North Atlantic historically (i.e., pre-whaling) supported between 9,000 and 21,000 right whales (Monsarrat et al. 2016). The western population may have numbered fewer than 100 individuals by 1935, when international protection for right whales came into effect (Kenney et al. 1995).

Genetic analysis, based upon mitochondrial and nuclear DNA analyses, have consistently revealed an extremely low level of genetic diversity in the North Atlantic right whale population (Hayes et al. 2018a, Malik et al. 2000, McLeod and White 2010, Schaeff et al. 1997). Waldick et al. (2002) concluded that the principal loss of genetic diversity occurred prior to the 18th century, with more recent studies hypothesizing that the loss of genetic diversity may have occurred prior to the onset of Basque whaling during the 16th and 17th century (Mcleod et al. 2008, Rastogi et al. 2004, Reeves et al. 2007, Waldick et al. 2002). The persistence of low genetic diversity in the North Atlantic right whale population might indicate inbreeding; however, based on available data, no definitive conclusions can be reached at this time (Hayes et al. 2019, Radvan 2019, Schaeff et al. 1997). By combining 25 years of field data (1980-2005) with high-resolution genetic data, Frasier et al. (2013) found that North Atlantic right whale calves born between 1980 and 2005 had higher levels of microsatellite (nuclear) heterozygosity than would be expected from this species' gene pool. The authors concluded that this level of heterozygosity is due to postcopulatory selection of genetically dissimilar gametes and that this mechanism is a natural means to mitigate the loss of genetic diversity, over time, in small populations (Frasier et al. 2013).

In the western North Atlantic, North Atlantic right whale abundance was estimated to be 270 animals in 1990 (Pace et al. 2017). Between 1990 and 2011, right whale abundance increased by approximately 2.8% per year, despite a decline in 1993 and no growth between 1997 and 2000 (Pace et al. 2017). However, since 2011, when the abundance peaked at 481 animals, the population has been in decline, with a 99.99% probability of a decline of just under 1% per year (Pace et al. 2017). Between 1990 and 2015, survival rates appeared relatively stable, but differed between the sexes, with males having higher survivorship than females (males: 0.985 ± 0.0038; females: 0.968 ± 0.0073) leading to a male-biased sex ratio (approximately 1.46 males per female) (Pace et al. 2017).

As reported in the most recent final SAR (Hayes et al. 2023), the western North Atlantic right whale stock size is estimated based on a published state-space model of the sighting histories of individual whales identified using photo-identification techniques (Pace et al. 2017; Pace 2021). Sightings histories were constructed from the photo-ID recapture database as it existed in December 2021, and included photographic information up through November 2020. Using a hierarchical, state-space Bayesian open population model of these histories produced a median abundance value (N_{est}) as of November 30, 2020 of 338 individuals (95% Credible Interval: 325–350). The minimum population estimate in the most recent SAR is 332 (Hayes et al. 2023). Linden 2023[13] updates the population size estimate of North Atlantic right whales at the beginning of 2022 using the most recent year of available sightings data (collected through December 2022) and the existing modeling approach. Using the established capture-recapture framework (Pace et al. 2017), the estimated population size in 2022 was 356 whales, with a 95% credible interval ranging from 346 to 363. Linden notes that given uncertainty in the accuracy of the terminal year estimate (Pace 2021), interpretations should focus on the multi-year population trend. The draft 2023 SAR is currently under review and revision. As reported in the publicly available draft (Hayes et al. 2024 DRAFT), a median abundance value (Nest) as of December 31, 2021, is 340 individuals (95% Credible Interval: 333-348). Each draft stock assessment report is peer-reviewed by one of three regional Scientific Review Groups, revised after a public comment period, and published. The sharp decrease observed from 2015-2020 appears to have slowed, though the right whale population continues to experience annual mortalities above recovery thresholds.

The annual calf count is highly variable; Pettis and Hamilton (2023) report a range of 5 (2017) to 39 (2009) calves from the 2009-2017 calving seasons. As noted above, no calves were observed in the 2018 season. Seven calves were born in 2019 and 10 in 2020 (not including a long calf observed in December 2020 off the Canary Islands). Fifteen mother calf pairs were sighted in 2022, down from 18 in 2021. There were no first time mothers sighted in 2022. Of the 15 calves born in 2022, one is known to have died and another is thought likely to have died. During the 2022-2023 season, there were 11 mothers with associated calves and one newborn documented alone that was later found dead. (Pettis and Hamilton 2023). Through July 15, 2024, 20 mother-calf pairs have been sighted in the 2023-2024 calving season which is considered a relatively productive year; of these, 4 are thought to be first time mothers. [14] One calf (mother Juno) had been sighted with injuries consistent with a vessel strike; while there were signs that the injuries were healing, the dead calf stranded in Georgia in early March. Additionally, three other calves are considered “missing” and are likely mortalities as the mothers have been seen alone after only a single sighting with their calves.

[13] Available at: https://www.fisheries.noaa.gov/s3/2023-10/TM314-508-0.pdf

[14] https://mission.cmaquarium.org/2023-2024-right-whale-calving-season/ and https://www.fisheries.noaa.gov/national/endangered-species-conservation/north-atlantic-right-whale-calving-season-2024

In addition to finding an overall decline in the North Atlantic right whale population, Pace et al. (2017) also found that between 1990 and 2015, the survival of age 5+ females relative to 5+ males has been reduced; this has resulted in diverging trajectories for male and female abundance. Specifically, there was an estimated 142 males (95% CI=143-152) and 123 females (95% CI=116-128) in 1990; however, by 2015, model estimates show the species was comprised of 272 males (95% CI=261-282) and 186 females (95% CI=174-195; Pace et al. 2017). Calving rates also varied substantially between 1990 and 2015 (i.e., 0.3% to 9.5%), with low calving rates coinciding with three periods (1993-1995, 1998-2000, and 2012-2015) of decline or no growth (Pace et al. 2017). Using generalized linear models, Corkeron et al. (2018) found that between 1992 and 2016, North Atlantic right whale calf counts increased at a rate of 1.98% per year. Using the highest annual estimates of survival recorded over the time series from Pace et al. (2017), and an assumed calving interval of approximately four years, Corkeron et al. (2018) suggests that the North Atlantic right whale population could potentially increase at a rate of at least 4% per year if there was no anthropogenic mortality.[15] This rate is approximately twice that observed, and the analysis indicates that adult female mortality is the main factor influencing this rate (Corkeron et al. 2018). Right whale births remain significantly below what is expected and the average inter-birth interval remains high (Frasier et al. 2023). Additionally, there were no first-time mothers in 2022 (Pettis et al. 2022), and only two first-time mothers in 2023 (Pettis and Hamilton 2023), underscoring recent research findings that fewer adult, nulliparous females are becoming reproductively active (Reed et al. 2022).

Status

The North Atlantic right whale is listed under the ESA as endangered. Anthropogenic mortality and sub-lethal stressors (i.e., entanglement) that affect reproductive success are currently affecting the ability of the species to recover (Corkeron et al. 2018, Stewart et al. 2021); currently, none of the species recovery goals (see below) have been met. With whaling now prohibited, the two major known human causes of mortality are vessel strikes and entanglement in fishing gear (Hayes et al. 2018a). Estimates of total annual anthropogenic mortality (i.e., ship strike and entanglement in fishing gear), as well as the number of undetected anthropogenic mortalities for North Atlantic right whales have been provided by Hayes et al. (2023) and Pace et al. (2017); these estimates show that the total annual North Atlantic right whale mortality exceed or equal the number of detected serious injuries and mortalities.[16] These anthropogenic threats appear to be worsening (Hayes et al. 2018a).

On June 7, 2017, NMFS declared an Unusual Mortality Event (UME) for the North Atlantic right whale UME, as a result of elevated right whale mortalities along the Western North Atlantic Coast. Under the Marine Mammal Protection Act, a UME is defined as "a stranding that is unexpected; involves a significant die-off of any marine mammal population; and demands immediate response." As of September 24, 2024, there are 142 individuals recorded as part of the UME. This includes 40 confirmed mortalities for the UME (with 1 pending), 36

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[15] Based on information in the North Atlantic Right Whale Catalog, the mean calving interval is 4.69 years (P. Hamilton 2018, unpublished, in Corkeron et al. 2018). Corkeron et al. (2018) assumed a 4 year calving interval as the approximate mid-point between the North Atlantic Right Whale Catalog calving interval and observed calving intervals for southern right whales (i.e., 3.16 years for South Africa, 3.42 years for Argentina, 3.31 years for Auckland Islands, and 3.3 years for Australia).

[16] Currently, 72% of mortalities since 2000 are estimated to have been observed (Hayes et al. 2020).

serious injuries (including 1 dependent calf), and 65 sublethal injuries or illness (for more information on UMEs, see https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-unusual-mortality-events). Mortalities are recorded as vessel strike (15), entanglement (9), perinatal (2), unknown/undetermined (3), not examined (11), and pending (1).[17] These values include the dead female right whale documented off Virginia in April 2024 (whose calf is missing and was last spotted in February) and the dead calf of Juno (previously recorded with vessel strike injuries) observed in March 2024.

The North Atlantic right whale population continues to decline. As provided above, between 1990 to 2011, right whale abundance increased by approximately 2.8% per year; however, since 2011 the population has been in decline (Pace et al. 2017). The 2023 SAR reports an overall abundance decline between 2011 and 2020 of 23.5% (CI=21.4% to 26.0%) (Hayes et al. 2023). Recent modeling efforts indicate that low female survival, a male biased sex ratio, and low calving success are contributing to the population's current decline (Pace et al. 2017).

Long-term photographic identification data also indicate new calves rarely go undetected, so these years likely represent a continuation of low calving rates that began in 2012 (Kraus et al. 2007, Pace et al. 2017). While there are likely a multitude of factors involved, low calving has been linked to poor female health (Rolland et al. 2016) and reduced prey availability (Devine et al. 2017, Johnson et al. 2017, Meyer-Gutbrod and Green 2014, Meyer-Gutbrod and Greene 2018, Meyer-Gutbrod et al. 2018). A recent study comparing North Atlantic right whales to other right whale species found that juvenile, adult, and lactating female North Atlantic right whales all had lower body condition scores compared to the southern right whale populations, with lactating females showing the largest difference (Christiansen et al. 2020). North Atlantic right whale calves were in good condition. While some of the difference could be the result of genetic isolation and adaptations to local environmental conditions, the authors suggest that the magnitude indicates that North Atlantic right are in poor condition, which could be suppressing their growth, survival, age of sexual maturation and calving rates. In addition, they conclude that the observed differences are most likely a result of differences in the exposure to anthropogenic factors (Christiansen et al. 2020). Furthermore, entanglement in fishing gear appears to have substantial health and energetic costs that affect both survival and reproduction (Hayes et al. 2018a, Hunt et al. 2016, Lysiak et al. 2018, Pettis et al. 2017, Robbins et al. 2015, Rolland et al. 2017, van der Hoop et al. 2017).

Kenney et al. (2018) projected that if all other known or suspected impacts (e.g., vessel strikes, calving declines, climate change, resource limitation, sublethal entanglement effects, disease, predation, and ocean noise) on the population remained the same between 1990 and 2016, and none of the observed fishery related mortality and/or serious injury occurred, the projected population in 2016 would be 12.2% higher (506 individuals). Furthermore, if the actual mortality resulting from fishing gear is double the observed rate (as estimated in Pace et al. 2017), eliminating all mortalities (observed and unobserved) could have resulted in a 2016 population increase of 24.6% (562 individuals) and possibly over 600 in 2018 (Kenney 2018).

[17] https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2024-north-atlantic-right-whale-unusual-mortality-event; last accessed September 24, 2024

Given the above information, North Atlantic right whales resilience to future perturbations is expected to be very low (Hayes et al. 2018a). The observed (and clearly biased low) human-caused mortality and serious injury was 7.7 right whales per year from 2015 through 2019 (Hayes et al. 2022). Using the refined methods of Pace et al. (2021), the estimated annual rate of total mortality for the period 2014–2018 was 27.4, which is 3.4 times larger than the 8.15 total derived from reported mortality and serious injury for the same period (Hayes et al. 2022). The 2023 SAR reports the observed human-caused mortality and serious injury was 8.1 right whales per year from 2016 through 2020 (Hayes et al. 2023). Using the refined methods of Pace et al. (2021), the estimated annual rate of total mortality for the period 2015–2019 was 31.2, which is 4.1 times larger than the 7.7 total derived from reported mortality and serious injury for the same period. Using a matrix population projection model, it is estimated that by 2029 the population will decline from 160 females to the 1990 estimate of 123 females if the current rate of decline is not altered (Hayes et al. 2018a).

Climate change poses a significant threat to the recovery of North Atlantic right whales. The information presented here is summarized from a more complete description of this threat in the 2022 5-Year Review (NMFS 2022). The documented shift in North Atlantic right whale summer habitat from the Gulf of Maine to waters further north in the Gulf of St. Lawrence in the early 2010s is considered to be related to an oceanographic regime shift in Gulf of Maine waters linked to a northward shift of the Gulf Stream which caused the availability of the primary North Atlantic right whale prey, the copepod *Calanus finmarchicus*, to decline locally, forcing North Atlantic right whales to forage in areas further north (Meyer-Gutbrod et al. 2021; Record et al. 2019; Sorochan et al. 2019). The shift of North Atlantic right whale distribution into waters further north also created policy challenges for the Canadian government, which had to implement new regulations in areas that were not protected because they were not documented as right whale habitat in the past (Davies and Brillant 2019; Meyer-Gutbrod et al. 2018; Record et al. 2019).

When prey availability is low, North Atlantic right whale calving rates decline, a well-documented phenomenon through periods of low prey availability in the 1990s and the 2010s; without increased prey availability in the future, low population growth is predicted (Meyer-Gutbrod and Greene 2018). Prey densities in the Gulf of St. Lawrence have fluctuated irregularly in the past decade, limiting suitable foraging habitat for North Atlantic right whales in some years and further limiting reproductive rates (Bishop et al. 2022; Gavrilchuck et al. 2020; Gavrilchuck et al. 2021; Lehoux et al. 2020).

Recent studies have investigated the spatial and temporal role of oceanography on copepod availability and distribution and resulting effects on foraging North Atlantic right whales. Changes in seasonal current patterns have an effect on the density of *Calanus* species in the Gulf of St. Lawrence, which may lead to further temporal variations over time (Sorochan et al. 2021a). Brennan et al. (2019) developed a model to estimate seasonal fluctuations in C. finmarchicus availability in the Gulf of St. Lawrence, which is highest in summer and fall, aligning with North Atlantic right whale distribution during those seasons. Pendleton et al. (2022) found that the date of maximum occupancy of North Atlantic right whales in Cape Cod Bay shifted 18.1 days later between 1998 and 2018 and was inversely related to the spring thermal transition date, when the regional ocean temperature surpasses the mean annual temperature for that location, which has trended towards moving earlier each year as an effect of climate change. This inverse relationship may be due to a 'waiting room' effect, where North Atlantic right whales wait and forage on adequate prey in the waters of Cape Cod Bay while richer prey develops in the Gulf of St. Lawrence, and then migrate directly there rather than following migratory pathways used previously (Pendleton et al. 2022; Ganley et al. 2022). The period of maximum occupancy in Cape Cod Bay has shifted to later in the spring, initial sightings of individual North Atlantic right whales have started earlier, indicating that they may be using regional water temperature as a cue for migratory movements between habitats (Ganley et al. 2022).

North Atlantic right whales rely on late stage or diapause copepods, which are more energy-rich, for prey; diving behavior is highly reliant on where in the vertical strata *C. finmarchicus* is distributed (Baumgartner et al. 2017). There is evidence that *C. finmarchicus* are reaching the diapause phase at deeper depths to account for warming water on the Newfoundland Slope and Scotian Shelf, forcing North Atlantic right whales to forage deeper and further from shore (Krumhansl et al. 2018; Sorochan et al. 2021a).

Several studies have already used the link between *Calanus* distribution and North Atlantic right whale distribution to determine suitable habitat, both currently and in the future (Gavrilchuk et al. 2020; Pershing et al. 2021; Silber et al. 2017; Sorochan et al. 2021b). Plourde et al. (2019) used suitable habitat modeling using *Calanus* density to confirm new North Atlantic right whale hot spots for summer feeding in Roseway Basin and Grand Manan and identified other potential aggregation areas further out on the Scotian Shelf. Gavrilchuk et al. (2021) determined suitable habitat for reproductive females in the Gulf of St. Lawrence, finding declines in foraging habitat over a 12- year period and indicating that the prey biomass in the area may become insufficient to sustain successful reproduction over time. Ross et al. (2021) used suitable habitat modeling to predict that the Gulf of Maine habitat would continue to decline in suitability until 2050 under a range of climate change scenarios. Similarly, models of future copepod density in the Gulf of Maine have predicted declines of up to 50 percent under high greenhouse gas emission scenarios by 2080- 2100 (Grieve et al. 2017). It is clear that climate change does and will continue to have an impact on the availability, supply, aggregation, and distribution of *C. finmarchicus*, and North Atlantic right whale abundance and distribution will continue to vary based on those impacts; however, more research must be done to better understand these factors and associated impacts (Sorochan et al. 2021b). Climate change will likely have other secondary effects on North Atlantic right whales, such as an increase in harmful algal blooms of the toxic dinoflagellate *Alexandrium catenella* due to warming waters, increasing the risk of North Atlantic right whale exposure to neurotoxins (Boivin-Rioux et al. 2021; Pershing et al. 2021).

Factors Outside the Action Area Affecting the Status of the Right Whale: Fishery Interactions and Vessel Strikes in Canadian Waters

In Canada, right whales are protected under the Species at Risk Act (SARA) and the Fisheries Act. The right whale was considered a single species and designated as endangered in 1980. SARA includes provisions against the killing, harming, harassing, capturing, taking, possessing, collecting, buying, selling, or trading of individuals or its parts (SARA section 32) and damage or destruction of its residence (SARA section 33). In 2003, the species was split to allow separate designation of the North Atlantic right whale, which was listed as endangered under

SARA in May 2003. All marine mammals are subject to the provisions of the marine mammal regulations under the Fisheries Act. These include requirements related to approach, disturbance, and reporting. In the St. Lawrence estuary and the Saguenay River, the approach distance for threatened or endangered whales is 1312 ft. (400 m).

North Atlantic right whales have died or been seriously injured in Canadian waters by vessel strikes and entanglement in fishing gear (DFO 2014). Serious injury and mortality events are rarely observed where the initial entanglement occurs. After an event, live whales or carcasses may travel hundreds of miles before ever being observed. It is unknown exactly how many serious injuries and mortalities have occurred in Canadian waters historically. However, at least 14 right whale carcasses and 20 injured right whales were sighted in Canadian waters between 1988 and 2014 (Davies and Brillant 2019); 25 right whale carcasses were first sighted in Canadian waters or attributed to Canadian fishing gear from 2015 through 2019. In the sections to follow, information is provided on the fishing and shipping industry in Canadian waters, as well as measures the Canadian government is taking (or will be taking) to reduce the level of serious injuries and mortalities to North Atlantic rights resulting from incidental entanglement in fishing gear or vessel strikes.

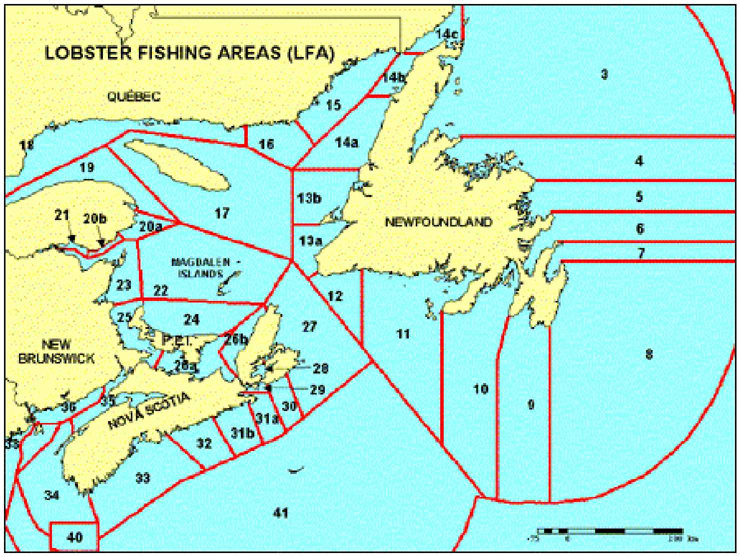
Fishery Interactions in Canadian Waters

There are numerous fisheries operating in Canadian waters. Rock and toad crab fisheries, as well as fixed gear fisheries for cod, Atlantic halibut, Greenland halibut, winter flounder, and herring have historically had few interactions. While these fisheries deploy gear that pose some risk, this analysis focuses on fisheries that have demonstrated interactions with ESA-listed species (i.e., lobster, snow crab, mackerel, and whelk). Based on information provided by the Department of Fisheries and Oceans Canada (DFO), a brief summary of these fisheries is provided below.

The American lobster fishery is DFO's largest fishery, by landings. It is managed under regional management plans with 41 Lobster Fisheries Areas (Figure 5.1.2) in which 10,000 licensed harvesters across Atlantic Canada and Quebec participate.[18] In addition to the one permanent closure in Lobster Fishery Area 40 (Figure 5.1.2), fisheries are generally closed during the summer to protect molts. Lobster fishing is most active in the Gulf of Maine, Bay of Fundy, Southern Gulf of St. Lawrence, and coastal Nova Scotia. Most fisheries take place in shallow waters less than 130 ft. (40 m) deep and within 8 nmi (15 km) of shore, although some fisheries will fish much farther out and in waters up to 660 ft. (200 m) deep. Management measures are tailored to each Area and include limits on the number of licenses issued, limits on the number of traps, limited and staggered fishing seasons, limits on minimum and maximum carapace size (which differs depending on the Area), protection of egg-bearing females (females must be notched and released alive), and ongoing monitoring and enforcement of fishing regulations and license conditions. The Canadian lobster fisheries use trap/pot gear consistent with the gear used in the American lobster fishery in the U.S. While both Canada and the U.S. lobster fisheries employ similar gears, the two nations employ different management strategies that result in divergent prosecution of the fisheries.

[18] Of the 41 Lobster Fisheries Areas, one is for the offshore fishery, and one is closed for conservation.

Figure 5.1.2. Lobster fishing areas in Atlantic Canada (https://www.dfo-mpo.gc.ca/fisheries-peches/commercial-commerciale/atl-arc/lobster-homard-eng.html)



The snow crab fishery is DFO's second largest fishery, by landings. It is managed under regional management plans with approximately 60 Snow Crab Management Areas in Canada spanning four regions (Scotia-Fundy, Southern Gulf of St. Lawrence, Northern Gulf of St. Lawrence, and Newfoundland and Labrador). In 2010, 4,326 snow crab fishery licenses were issued. The DFO website indicated that 3,703 permits were issued in 2017[19]. The management of the snow crab fishery is based on annual total allowable catch, individual quotas, trap and mesh restrictions, minimum legal size, mandatory release of female crabs, minimum mesh size of traps, limited seasons, and areas. Protocols are in place to close grids when a percentage of soft-shell crabs in catches is reached. Harvesters use baited conical traps and pots set on muddy or sand-mud bottoms usually at depths of 230-460 ft. (70-140 m). Annual permit conditions have been used since 2017 to minimize the impacts to North Atlantic right whales, as described below.

DFO manages the Atlantic mackerel fishery under one Atlantic management plan, established in 2007. Management measures include fishing seasons, total allowable catch, gear, Safety at Sea fishing areas, licensing, minimum size, fishing gear restrictions, and monitoring. The plan allows the use of the following gear: gillnet, handline, trap net, seine, and weir. When established, the DFO issued 17,182 licenses across four regions, with over 50% of these licenses using gillnet gear. In 2017, DFO issued 7,965 licenses (http://www.dfo-mpo.gc.ca/stats/commercial/licences-permis/species-especes/se17-eng.htm); no gear information was available. Commercial harvest is timed with the migration of mackerel into and out of Canadian waters. In Nova Scotia, the gillnet and trap fisheries for mackerel take place primarily in June and July. Mackerel generally arrive in southwestern Nova Scotia in May and Cape Breton in June. Migration out of the Gulf of St. Lawrence begins in September, and the fishery can continue into October or early November. They may enter the Gulf of St. Lawrence, depending on temperature conditions. The gillnet fishery in the Gulf of St. Lawrence also occurs

19 (http://www.dfo-mpo.gc.ca/stats/commercial/licences-permis/species-especes/se17-eng.htm)

in June and July. Most nets are fixed, except for a drift fishery in Chaleurs Bay and the part of the Gulf between New Brunswick, Prince Edward Island, and the Magdalen Islands.

Conservation harvesting plans are used to manage waved whelk in Canadian waters, which are harvested in the Gulf of St. Lawrence, Quebec, Maritimes, and Newfoundland and Labrador regions. The fishery is managed using quotas, fishing gear requirements, dockside monitoring, traps limits, seasons, tagging, and area requirements. In 2017, there were 240 whelk license holders in Quebec; however, only 81 of them were active. Whelk traps are typically weighted at the bottom with cement or other means and a rope or other mechanism is positioned in the center of the trap to secure the bait. Between 50 and 175 traps are authorized per license. The total number of authorized traps for all licenses in each fishing area varies between 550 and 6,400 traps, while the number of used or active traps is lower, with 200 to 1,700 traps per fishing area.

Since 2017, the Government of Canada has implemented measures to protect right whales from entanglement. These measures have included seasonal and dynamic closures for fixed gear fisheries, changes to the fishing season for snow crab, reductions in traps in the mid-shore fishery in Crab Fishing Area 12, and license conditions to reduce the amount of rope in the water. Measures to better track gear, require reporting of gear loss, require reporting of interactions with marine mammals, and increased surveillance for right whales have also been implemented. Measures to reduce interactions with fishing gear are adjusted annually. More information on these measures is available at https://www.dfo-mpo.gc.ca/fisheries-peches/commercial-commerciale/atl-arc/narw-bnan/management-gestion-eng.html.

In August 2016, NMFS published the MMPA Import Provisions Rule (81 FR 54389, August 15, 2016), which established criteria for evaluating a harvesting nation's regulatory program for reducing marine mammal bycatch and the procedures for obtaining authorization to import fish and fish products into the United States. Specifically, to continue in the international trade of seafood products with the United States, other nations must demonstrate that their marine mammal mitigation measure for commercial fisheries are, at a minimum, equivalent to those in place in the United States. A five-year exemption period (beginning January 1, 2017) was created in this process to allow foreign harvesting nations time to develop, as appropriate, regulatory programs comparable in effectiveness to U.S. programs at reducing marine mammal bycatch. To comply with its requirements, it is essential that these interactions are reported, documented, and quantified. To guarantee that fish products have access to the U.S. markets, DFO must implement procedures to reliably certify that the level of mortality caused by fisheries does not exceed U.S. standards. DFO must also demonstrate that the regulations in place to reduce accidental death of marine mammals are comparable to those of the United States.

Vessel Strikes in Canadian Waters

Vessel strikes are a threat to right whales throughout their range. In Canadian waters where rights whales are present, vessels include recreational and commercial vessels, small and large vessels, and sail, and power vessels. Vessel categories include oil and gas exploration, fishing and aquaculture, cruise ships, offshore excursions (whale and bird watching), tug/tow, dredge, cargo, and military vessels. At the time of development of the Gulf of St. Lawrence management plan, approximately 6400 commercial vessels transited the Cabot Strait and the Strait of Belle Isle annually. This represents a subset of the vessels in this area as it only includes commercial vessels (DFO 2013). To address vessel strikes in Canadian waters, the International Maritime Organization (IMO) amended the Traffic Separation Scheme in the Bay of Fundy to reroute vessels around high use areas. In 2007, IMO adopted and Canada implemented a voluntary seasonal Area to Be Avoided (ATBA) in Roseway Basin to further reduce the risk of vessel strike (DFO 2020). In addition, Canada has implemented seasonal speed restrictions and developed a proposed action plan to identify specific measures needed to address threats and achieve recovery (DFO 2020).

The Government of Canada has also implemented measures to mitigate vessel strikes in Canadian waters. Each year since August 2017, the Government has implemented seasonal speed restrictions (maximum 10 knots) for vessels 20 meters or longer in the western Gulf of St. Lawrence. In 2019, the area was adjusted and the restriction was expanded to apply to vessels greater than 13 m; smaller vessels are encouraged to respect the limit. Dynamic area management has also been used in recent years. Currently, there are two shipping lanes, south and north of Anticosti Island, where dynamic speed restrictions (mandatory slowdown to 10 knots) can be activated when right whales are present. In 2020 and 2021, the Government of Canada also implemented a trial voluntary speed restriction zone from Cabot Strait to the eastern edge of the dynamic shipping zone at the beginning and end of the season and a mandatory restricted area in or near Shediac Valley mid-season. Modifications to measures in 2021 include refining the size, location, and duration of the mandatory restricted area in and near Shediac Valley and expanding the speed limit exemption in waters less than 20 fathoms to all commercial fishing vessels. Since 2021, a variety of measures were in place to reduce the risk of vessel strike including vessel speed limits and restricted access areas. More information is available at https://www.tc.gc.ca/en/services/marine/navigation-marine-conditions/protecting-north-atlantic-right-whales-collisions-ships-gulf-st-lawrence.html.

Critical Habitat

Critical habitat for North Atlantic right whales has been designated as described in Section 4.0 *Species and Critical Habitat Not Considered Further in this Opinion*.

Recovery Goals

Recovery is the process of restoring endangered and threatened species to the point where they no longer require the safeguards of the Endangered Species Act. A recovery plan serves as a road map for species recovery—the plan outlines the path and tasks required to restore and secure self-sustaining wild populations. It is a non-regulatory document that describes, justifies, and schedules the research and management actions necessary to support recovery of a species. The goal of the 2005 Recovery Plan for the North Atlantic right whale (NMFS, 2005) is to promote the recovery of North Atlantic right whales to a level sufficient to warrant their removal from the List of Endangered and Threatened Wildlife and Plants under the ESA. The intermediate goal is to reclassify the species from endangered to threatened. The recovery strategy identified in the Recovery Plan focuses on reducing or eliminating deaths and injuries from anthropogenic activities, namely shipping and commercial fishing operations; developing demographically-based recovery criteria; the characterization, monitoring, and protection of important habitat; identification and monitoring of the status, trends, distribution and health of the species; conducting studies on the effects of other potential threats and ensuring that they are addressed, and conducting genetic studies to assess population structure and diversity.

The plan also recognizes the need to work closely with State, other Federal, international and private entities to ensure that research and recovery efforts are coordinated. The plan includes the following downlisting criteria, the achievement of which would demonstrate significant progress toward full recovery:

> North Atlantic right whales may be considered for reclassifying to threatened when all of the following have been met: 1) The population ecology (range, distribution, age structure, and gender ratios, etc.) and vital rates (age-specific survival, age-specific reproduction, and lifetime reproductive success) of right whales are indicative of an increasing population; 2) The population has increased for a period of 35 years at an average rate of increase equal to or greater than 2% per year; 3) None of the known threats to North Atlantic right whales (summarized in the five listing factors) are known to limit the population's growth rate; and 4) Given current and projected threats and environmental conditions, the right whale population has no more than a 1% chance of quasi-extinction in 100 years.

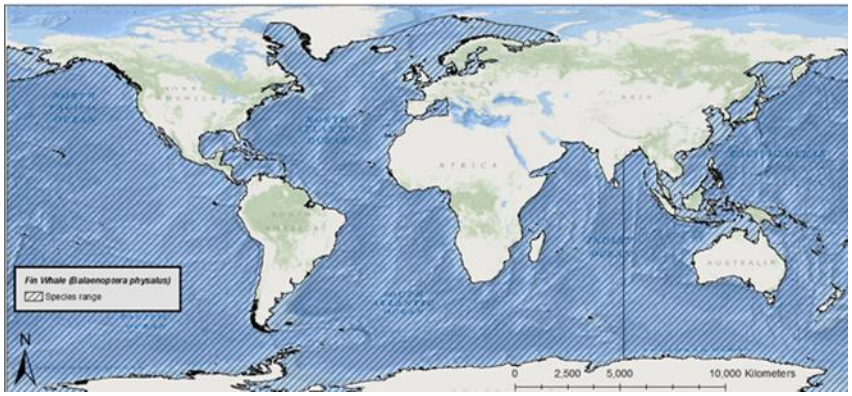
Specific criteria for delisting North Atlantic right whales are not included in the recovery plan; as described in the recovery plan, conditions related to delisting are too distant and hypothetical to realistically develop specific criteria. The current abundance of North Atlantic right whales is currently an order of magnitude less than an abundance at which NMFS would even consider delisting the species. The current dynamics indicate that the North Atlantic right whale population is in decline, rather than recovering, and decades of population growth at rates considered typical for large whales would be required before the population could attain an abundance that may suggest that delisting was appropriate to consider. Specific criteria for delisting North Atlantic right whales will be included in a future revision of the recovery plan well before the population is at a level when delisting becomes a reasonable decision (NMFS 2005).

The most recent five-year review for right whales was completed in 2022 (NMFS 2022). The recommendation in that review was for the status to remain as endangered. As described in the report, the North Atlantic right whale faces continued threat of human-caused mortality due to lethal interactions with commercial fisheries and vessel traffic. As stated in the 5-Year Review, there is also uncertainty regarding the effect of long-term sublethal entanglements, emerging environmental stressors including climate change, and the compounding effects of multiple continuous stressors that may be limiting North Atlantic right whale calving and recovery. In addition, the North Atlantic right whale population has been in a state of decline since 2010. Management measures in the United States have been in place for an extended period of time and continued modifications are underway/anticipated, and measures in Canada since 2017 also suggest continued progress toward implementing conservation regulations. Despite these efforts to reduce the decline and promote recovery, progress toward right whale recovery has continued to regress.

5.1.2 Fin Whale (Balaenoptera physalus)

Globally there is one species of fin whale, *Balaenoptera physalus*. Fin whales occur in all major oceans of the Northern and Southern Hemispheres (NMFS 2010a) (Figure 5.1.3). Within this range, three subspecies of fin whales are recognized: *B. p. physalus* in the Northern Hemisphere, and *B. p. quoyi* and *B. p. patachonica* (a pygmy form) in the Southern Hemisphere (NMFS 2010a). For management purposes in the northern Hemisphere, the United States divides, *B. p. physalus*, into four stocks: Hawaii, California/Oregon/Washington, Alaska (Northeast Pacific), and Western North Atlantic (Hayes et al. 2019, NMFS 2010a).

Figure 5.1.3. Range of the fin whale



Fin whales are distinguishable from other whales by a sleek, streamlined body, with a V-shaped head, a tall hooked dorsal fin, and a distinctive color pattern of a black or dark brownish-gray body and sides with a white ventral surface. The lower jaw is gray or black on the left side and creamy white on the right side. The fin whale was listed as endangered on December 2, 1970 (35 FR 18319).

Information available from the recovery plan (NMFS 2010a), recent stock assessment reports (Carretta et al. 2019a, Hayes et al. 2022, Muto et al. 2019a), the five-year status review (NMFS 2019b), as well as the recent International Union for the Conservation of Nature's (IUCN) fin whale assessment (Cooke 2018b) were used to summarize the life history, population dynamics and status of the species as follows.

Life History

Fin whales can live, on average, 80 to 90 years. They have a gestation period of less than one year, and calves nurse for six to seven months. Sexual maturity is reached between 6 and 10 years of age with an average calving interval of two to three years. They mostly inhabit deep, offshore waters of all major oceans. They winter at low latitudes, where they calve and nurse, and summer at high latitudes, where they feed, although some fin whales appear to be residential to certain areas.

Population Dynamics

The pre-exploitation estimate for the fin whale population in the entire North Atlantic was approximately 30,000-50,000 animals (NMFS 2010a), and for the entire North Pacific Ocean, approximately 42,000 to 45,000 animals (Ohsumi and Wada 1974). In the Southern Hemisphere, prior to exploitation, the fin whale population was approximately 40,000 whales (Mizroch et al. 1984b). In the North Atlantic Ocean, fin whales were heavily exploited from 1864 to the 1980s; over this timeframe, approximately 98,000 to 115,000 fin whales were killed (IWC 2017). Between 1910 and 1975, approximately 76,000 fin whales were recorded taken by modern whaling in the North Pacific; this number is likely higher as many whales killed were not identified to species or while killed, where not successfully landed (Allison 2017). Over 725,000 fin whales were killed in the Southern Hemisphere from 1905 to 1976 (Allison 2017).

In the North Atlantic Ocean, the IWC has defined seven management stocks of fin whales: (1) North Norway; (2) East Greenland and West Iceland (EGI); (3) West Norway and the Faroes; (4) British Isles, Spain and Portugal; (5) West Greenland; and (6) Nova Scotia, (7) Newfoundland and Labrador (Donovan 1991, NMFS 2010a). Based on three decades of survey data in various portions of the North Atlantic, the IWC estimates that there are approximately 79,000 fin whales in this region. Under the present IWC scheme, fin whales off the eastern United States, Nova Scotia and the southeastern coast of Newfoundland are believed to constitute a single stock; in U.S. waters, NMFS classifies these fin whales as the Western North Atlantic stock (Donovan 1991, Hayes et al. 2019, NMFS 2010a). NMFS' best estimate of abundance for the Western North Atlantic Stock of fin whales is 6,802 individuals (N_{min}=5,573); this estimate is the sum of the 2016 NOAA shipboard and aerial surveys and the 2016 Canadian Northwest Atlantic International Sightings Survey (Hayes et al. 2022). Currently, there is no population estimate for the entire fin whale population in the North Pacific (Cooke 2018b). However, abundance estimates for three stocks in U.S. Pacific Ocean waters do exist: Northeast Pacific (N= 3,168; N_{min}=2,554), Hawaii (N=154; N_{min}=75), and California/Oregon/Washington (N= 9,029; N_{min}=8,127) (Nadeem et al. 2016). Abundance data for the Southern Hemisphere stock remain highly uncertain; however, available information suggests a substantial increase in the population has occurred (Thomas et al. 2016).

In the North Atlantic, estimates of annual growth rate for the entire fin whale population in this region is not available (Cooke 2018b). However, in U.S. Atlantic waters NMFS has determined that until additional data is available, the cetacean maximum theoretical net productivity rate of 4.0% will be used for the Western North Atlantic stock (Hayes et al. 2022). In the North Pacific, estimates of annual growth rate for the entire fin whale population in this region is not available (Cooke 2018b). However, in U.S. Pacific waters, NMFS has determined that until additional data is available, the cetacean maximum theoretical net productivity rate of 4.0% will be used for the Northeast Pacific stock (Muto et al. 2019b, NMFS 2016b). Overall population growth rates and total abundance estimates for the Hawaii stock of fin whales are not available at this time (Carretta et al. 2018). Based on line transect studies between 1991-2014, there was estimated a 7.5% increase in mean annual abundance in fin whales occurring in waters off California, Oregon, and Washington; to date, this represents the best available information on the current population trend for the overall California/Oregon/Washington stock of fin whales (Carretta et al. 2019a, Nadeem et al. 2016).[20] For Southern Hemisphere fin whales, as noted above, overall information suggests a substantial increase in the population; however, the rate of increase remains poorly quantified (Cooke 2018b).

Archer et al. (2013) examined the genetic structure and diversity of fin whales globally. Full sequencing of the mitochondrial DNA genome for 154 fin whales sampled in the North Atlantic Ocean, North Pacific Ocean, and Southern Hemisphere, resulted in 136 haplotypes, none of which were shared among ocean basins suggesting differentiation at least at this geographic

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[20] Since 2005, the fin whale abundance increase has been driven by increases off northern California, Oregon, and Washington; numbers off Central and Southern California have remained stable (Carretta et al. 2020, Nadeem et al. 2016).

scale. However, North Atlantic fin whales appear to be more closely related to the Southern Hemisphere population, as compared to fin whales in the North Pacific Ocean, which may indicate a revision of the subspecies delineations is warranted. Generally, haplotype diversity was found to be high both within and across ocean basins (Archer et al. 2013). Such high genetic diversity and lack of differentiation within ocean basins may indicate that despite some populations having small abundance estimates, the species may persist long-term and be somewhat protected from substantial environmental variance and catastrophes. Archer et al. 2019 suggests that within the Northern Hemisphere, populations in the North Pacific and North Atlantic oceans can be considered at least different subspecies, if not different species.

Status

The fin whale is endangered because of past commercial whaling. Prior to commercial whaling, hundreds of thousands of fin whales existed. Fin whales may be killed under "aboriginal subsistence whaling" in Greenland, under Japan's scientific whaling program, and Iceland's formal objection to the IWC's ban on commercial whaling. Additional threats include vessel strikes, reduced prey availability due to overfishing or climate change, and sound. The species' overall large population size (minimum population size 65,573, Hayes et al. 2022) may provide some resilience to current threats, but trends are largely unknown. The total annual estimated average human-caused mortality and serious injury for the western North Atlantic fin whale for the period 2015−2019 is 1.85 (1.45 incidental fishery interactions and 0.40 vessel collisions) (Henry et al. 2022). Hayes et al. 2022 notes that these represent a minimum estimate of human-caused mortality, which is almost certainly biased low.

Critical Habitat

No critical habitat has been designated for the fin whale.

Recovery Goals

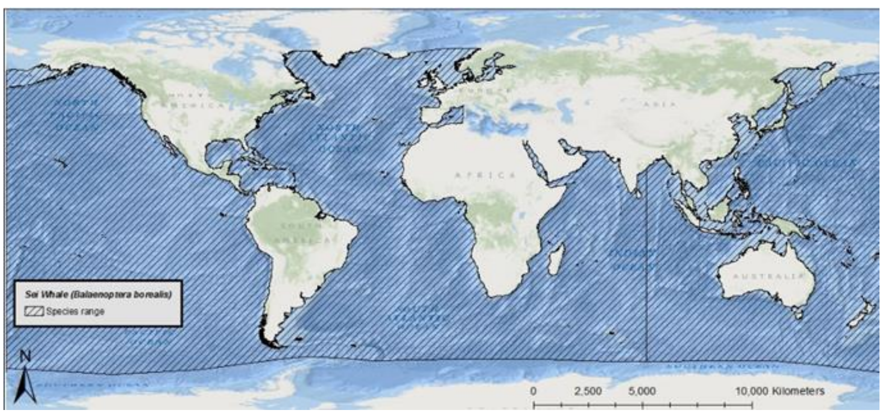
The goal of the 2010 Recovery Plan for the fin whale (NMFS 2010a) is to promote the recovery of fin whales to the point at which they can be downlisted from endangered to threatened status, and ultimately to remove them from the list of Endangered and Threatened Wildlife and Plants, under the provisions of the ESA. The intermediate goal is to reclassify the species from endangered to threatened. The recovery plan also includes downlisting and delisting criteria. Key elements for the recovery program for fin whales are:

1. Coordinate state, federal, and international actions to implement recovery actions and maintain international regulation of whaling for fin whales;
2. Determine population discreteness and population structure of fin whales;
3. Develop and apply methods to estimate population size and monitor trends in abundance;
4. Conduct risk analysis;
5. Identify, characterize, protect, and monitor habitat important to fin whale populations in U.S. waters and elsewhere;
6. Investigate causes and reduce the frequency and severity of human-caused injury and mortality;
7. Determine and minimize any detrimental effects of anthropogenic noise in the oceans;
8. Maximize efforts to acquire scientific information from dead, stranded, and/or entrapped fin whales; and,
9. Develop post-delisting monitoring plan.

In February 2019, NMFS published a Five-Year Review for fin whales. This 5-year review indicates that, based on a review of the best available scientific and commercial information, that the fin whale should be downlisted from endangered to threatened. The review also recommended that NMFS consider whether listing at the subspecies or distinct population segment level is appropriate in terms of potential conservation benefits and the use of limited agency resources (NMFS 2019). To date, no changes to the listing for fin whales have been proposed.

5.1.3 Sei Whale (Balaenoptera borealis)
Globally there is one species of sei whale, *Balaenoptera borealis*. Sei whales occur in subtropical, temperate, and subpolar marine waters across the Northern and Southern Hemispheres (Figure 5.1.4) (Cooke 2018a, NMFS 2011a). For management purposes, in the Northern Hemisphere, the United States recognizes four sei whale stocks: Hawaii, Eastern North Pacific, and Nova Scotia (NMFS 2011a).

Figure 5.1.4. Range of the sei whale



Sei whales are distinguishable from other whales by a long, sleek body that is dark bluish-gray to black in color and pale underneath, and a single ridge located on their rostrum. The sei whale was listed as endangered on December 2, 1970 (35 FR 18319).

Information available from the recovery plan (NMFS 2011a), recent stock assessment reports (Carretta et al. 2019a, Hayes et al. 2020, Hayes et al. 2017), status review (NMFS 2012), as well as the recent IUCN sei whale assessment (Cooke 2018a) were used to summarize the life history, population dynamics, and status of the species as follows.

Life History
Sei whales can live, on average, between 50 and 70 years. They have a gestation period of 10 to 12 months, and calves nurse for six to nine months. Sexual maturity is reached between 6 and 12 years of age with an average calving interval of two to three years. Sei whales mostly inhabit continental shelf and slope waters far from the coastline. They winter at low latitudes, where they calve and nurse, and summer at high latitudes, where they feed on a range of prey types, including: plankton (copepods and krill), small schooling fishes, and cephalopods.

Population Dynamics
There are no estimates of pre-exploitation sei whale abundance in the entire North Atlantic Ocean; however, approximately 17,000 sei whales were documented caught by modern whaling in the North Atlantic (Allison 2017). In the North Pacific, the pre-whaling sei abundance was estimated to be approximately 42,000 (Tillman 1977 as cited in NMFS 2011a). In the Southern Hemisphere, approximately 63,100 to 65,000 occurred in the Southern Hemisphere prior to exploitation (Mizroch et al. 1984a, NMFS 2011a).

In 1989, the entire North Atlantic sei whale population was estimated to be 10,300 whales (Cattanach et al. 1993 as cited in (NMFS 2011a). While other surveys have been completed in portions of the North Atlantic since 1989, the survey coverage levels in these studies are not as complete as those done in Cattanach et al. (1993) (Cooke 2018a). As a result, to date, updated abundance estimates for the entire North Atlantic population of sei whales are not available. However, in the western North Atlantic, Palka et al. (2017) has provided a recent abundance estimate for the Nova Scotia stock of sei whales. Based on survey data collected from Halifax, Nova Scotia, to Florida between 2010 and 2013, it is estimated that there are approximately 6,292 sei whales (N_{min}=3,098) (Palka et al. 2017); this estimate is considered the best available for the Nova Scotia stock (Hayes 2019). In the North Pacific, an abundance estimate for the entire North Pacific population of sei whales is not available. However, in the western North Pacific, it is estimated that there are 35,000 sei whales (Cooke 2018a). In the eastern North Pacific (considered east of longitude 180^{o}), two stocks of sei whales occur in U.S. waters: Hawaii and Eastern North Pacific. Abundance estimates for the Hawaii stock are 391 sei whales (N_{min}=204), and for Eastern North Pacific stock, 519 sei whales (N_{min}=374) (Carretta et al. 2019a). In the Southern Hemisphere, recent abundance of sei whales is estimated at 9,800 to 12,000 whales. Population growth rates for sei whales are not available at this time as there are little to no systematic survey efforts to study sei whales; however, in U.S. waters, NMFS has determined that until additional data is available, the cetacean maximum theoretical net productivity rate of 4.0% will be used for the Hawaii, Eastern North Pacific, and Hawaii stocks of sei whales (Hayes 2019).

Based on genetic analyses, there appears to be some differentiation between sei whale populations in different ocean basins. In an early analysis of genetic variation in sei whales, some differences between Southern Ocean and the North Pacific sei whales were detected (Wada and Numachi 1991). However, more recent analyses of mtDNA control region variation show no significant differentiation between Southern Ocean and the North Pacific sei whales, though both appear to be genetically distinct from sei whales in the North Atlantic (Huijser et al. 2018). Within each ocean basin, there appears to be intermediate to high genetic diversity and little genetic differentiation despite there being different managed stocks (Danielsdottir et al. 1991, Kanda et al. 2011, Kanda et al. 2006, Kanda et al. 2013, Kanda et al. 2015).

Status
The sei whale is endangered because of past commercial whaling. Now, only a few individuals are taken each year by Japan. Current threats include vessel strikes, fisheries interactions (including entanglement), climate change (habitat loss and reduced prey availability), and anthropogenic sound. Given the species' overall abundance, they may be somewhat resilient to current threats. However, trends are largely unknown, especially for individual stocks, many of

which have relatively low abundance estimates. The most recent 5-year average human-caused mortality and serious injury rate for sei whales in the North Atlantic is 0.80 (0.4 incidental fishery interactions, 0.2 vessel collisions, 0.2 other human-caused mortality; Hayes et al. 2022). These represent a minimum estimate of human-caused mortality, which is almost certainly biased low.

Critical Habitat
No critical habitat has been designated for the sei whale.

Recovery Goals
The 2011 Recovery Plan for the sei whale (NMFS 2011b) indicates that, "because the current population status of sei whales is unknown, the primary purpose of this Recovery Plan is to provide a research strategy to obtain data necessary to estimate population abundance, trends, and structure and to identify factors that may be limiting sei whale recovery." The goal of the Recovery Plan is to promote the recovery of sei whales to the point at which they can be downlisted from Endangered to Threatened status, and ultimately to remove them from the list of Endangered and Threatened Wildlife and Plants, under the provisions of the ESA. The intermediate goal is to reclassify the species from endangered to threatened. The recovery plan incorporates an adaptive management strategy that divides recovery actions into three tiers. Tier I involves: 1) continued international regulation of whaling (i.e., a moratorium on commercial sei whaling); 2) determining population size, trends, and structure using opportunistic data collection in conjunction with passive acoustic monitoring, if determined to be feasible; and 3) continued stranding response and associated data collection.

NMFS completed the most recent five-year review for sei whales in 2021 (NMFS 2021). In that review, NMFS concluded that the listing status should remain unchanged. They also concluded that recovery criteria outlined in the sei whale recovery plan (NMFS 2011) do not reflect the best available and most up-to date information on the biology of the species. The 5-Year review states that currently, there is insufficient data to undertake an assessment of the sei whale's present status due to a number of uncertainties and unknowns for this species: (1) lack of scientifically reliable population estimates for the North Atlantic and Southern Hemisphere; (2) lack of comprehensive information on status and trends; (3) existence of critical knowledge gaps; and (4) emergence of potential new threats. Thus, further research is needed to fill critical knowledge gaps.

5.1.4 Sperm Whale (Physeter macrocephalus)
Globally there is one species of sperm whale, *Physeter macrocephalus*. Sperm whales occur in all major oceans of the Northern and Southern Hemispheres (NMFS 2010b)(Figure 5.1.5). For management purposes, in the Northern Hemisphere, the United States recognizes six sperm whale stocks: California/Oregon/Washington, Hawaii, North Pacific, North Atlantic, Northern Gulf of Mexico, and Puerto Rico and the U.S. Virgin Islands (NMFS 2010b); see NMFS Marine Mammal Stock Assessment Reports: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-species-stock).

Figure 5.1.5. Range of the sperm whale

The sperm whale is the largest toothed whale and distinguishable from other whales by its extremely large head, which takes up 25 to 35% of its total body length and a single blowhole asymmetrically situated on the left side of the head near the tip. The sperm whale was originally listed as endangered on December 2, 1970 (35 FR 18319).

Information available from the recovery plan (NMFS 2010b), recent stock assessment reports (Carretta et al. 2018, Hayes et al. 2020 and 2018b, Muto et al. 2018), status review (NMFS 2015b), as well as the recent IUCN sperm whale assessment (Taylor et al. 2019) were used to summarize the life history, population dynamics and status of the species as follows.

Life History
The average lifespan of sperm whales is estimated to be at least 50 years (Whitehead 2009). They have a gestation period of one to one and a half years, and calves nurse for approximately two years, though they may begin to forage for themselves within the first year of life (Tønnesen et al. 2018). Sexual maturity is reached between 7 and 13 years of age for females with an average calving interval of four to six years. Male sperm whales reach full sexual maturity in their 20s. Sperm whales mostly inhabit areas with a water depth of 1970 ft. (600 m) or more, and are uncommon in waters less than 985 ft. (300 m) deep. They winter at low latitudes, where they calve and nurse, and summer at high latitudes, where they feed primarily on squid; other prey includes octopus and demersal fish (including teleosts and elasmobranchs).

Population Dynamics
Pre-whaling, the global population of sperm whales was estimated to be approximately 1,100,000 animals (Taylor et al. 2019, Whitehead 2002). By 1880, due to whaling, the population was approximately 71% of its original level (Whitehead 2002). In 1999, ten years after the end of large-scale whaling, the population was estimated to be about 32% of its original level (Whitehead 2002).

The most recent global sperm whale population estimate is 360,000 whales (Whitehead 2009). There are no reliable estimates for sperm whale abundance across the entire (North and South) Atlantic Ocean. However, estimates are available for two of three U.S. stocks in the western North Atlantic Ocean; the Northern Gulf of Mexico stock is estimated to consist of 763 individuals (N_{min}=560) (Waring et al. 2016) and the North Atlantic stock is estimated to consist of 4,349 individuals (N_{min}=3,451) (Hayes et al. 2020). There are insufficient data to estimate abundance for the Puerto Rico and U.S. Virgin Islands stock. Similar to the Atlantic Ocean, there are no reliable estimates for sperm whale abundance across the entire (North and South)

Pacific Ocean. However, estimates are available for two of three U.S. stocks that occur in the eastern Pacific; the California/Oregon/ Washington stock is estimated to consist of 1,997 individuals (N_{min}=1,270; Carretta et al. 2019b), and the Hawaii stock is estimated to consist of 4,559 individuals (N_{min}=3,478) (Carretta et al. 2019a). We are aware of no reliable abundance estimates for sperm whales in other major oceans in the Northern and Southern Hemispheres. Although maximum net productivity rates for sperm whales have not been clearly defined, population growth rates for sperm whale populations are expected to be low (i.e., no more than 1.1% per year) (Whitehead 2002). In U.S. waters, NMFS determined that, until additional data is available, the cetacean maximum theoretical net productivity rate of 4.0% will be used for, among others, the North Atlantic, Northern Gulf of Mexico, and Puerto Rico and the U.S. Virgin Islands stocks of sperm whales (Hayes et al. 2020, Hayes et al. 2021).

Ocean-wide genetic studies indicate sperm whales have low genetic diversity, suggesting a recent bottleneck, but strong differentiation between matrilineally related groups (Lyrholm and Gyllensten 1998). Consistent with this, two studies of sperm whales in the Pacific Ocean indicate low genetic diversity (Mesnick et al. 2011, Rendell et al. 2012). Furthermore, sperm whales from the Gulf of Mexico, the western North Atlantic Ocean, the North Sea, and the Mediterranean Sea all have been shown to have low levels of genetic diversity (Engelhaupt et al. 2009). As none of the stocks for which data are available have high levels of genetic diversity, the species may be at some risk to inbreeding and 'allee' effects[21], although the extent to which is currently unknown. Sperm whales have a global distribution and can be found in relatively deep waters in all ocean basins. While both males and females can be found in latitudes less than 40 degrees, only adult males venture into the higher latitudes near the poles.

Status

The sperm whale is endangered as a result of past commercial whaling. Although the aggregate abundance worldwide is probably at least several hundred thousand individuals, the extent of depletion and degree of recovery of populations are uncertain. Commercial whaling is no longer allowed, however, illegal hunting may occur. Continued threats to sperm whale populations include vessel strikes, entanglement in fishing gear, competition for resources due to overfishing, population, loss of prey and habitat due to climate change, and sound. The Deepwater Horizon Natural Resource Damage Assessment Trustees assessed effects of oil exposure on sea turtles and marine mammals. Sperm whales in the Gulf of Mexico were impacted by the oil spill with 3% of the stock estimated to have died (DWH NRDA Trustees 2016). The species' large population size shows that it is somewhat resilient to current threats. The most recent SAR for sperm whales in the North Atlantic notes that there were no documented reports of fishery-related mortality or serious injury to the North Atlantic stock in the U.S. EEZ during 2013–2017 (Hayes et al. 2020); there are also no reports in NMFS records from 2018-2023. During the 2013-2017 period, there were 12 sperm whale strandings documented along the U.S. Atlantic coast within the EEZ, none of these strandings were classified as human interactions (Hayes et al. 2020). The species' large population size shows that it is somewhat resilient to current threats.

Critical Habitat

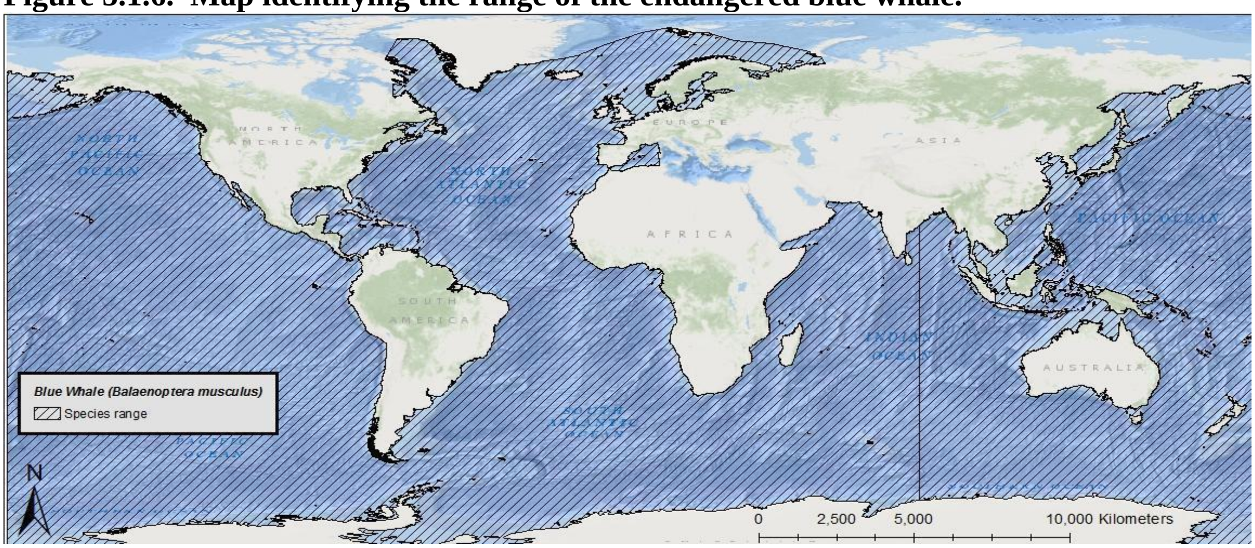
[21] Allee effects are broadly characterized as a decline in individual fitness in populations with a small size or density.

No critical habitat has been designated for the sperm whale.

Recovery Goals
The goal of the Recovery Plan is to promote recovery of sperm whales to a point at which they can be downlisted from endangered to threatened status, and ultimately to remove them from the list of Endangered and Threatened Wildlife and Plants, under the provisions of the ESA. The primary purpose of this Recovery Plan is to identify and take actions that will minimize or eliminate effects of human activities that are detrimental to the recovery of sperm whale populations. Immediate objectives are to identify factors that may be limiting abundance/recovery/ productivity, and cite actions necessary to allow the populations to increase. The Recovery Plan includes downlisting and delisting criteria (NMFS 2010).

The most recent Five-Year Review for sperm whales was completed in 2015 (NMFS 2015). In that review, NMFS concluded that no change to the listing status was recommended.

5.1.5 Blue Whale (Balaenoptera musculus)
Blue whales are the largest animal on earth and distinguishable from other whales by a long-body and comparatively slender shape, a broad, flat "rostrum" when viewed from above, proportionally smaller dorsal fin, and are a mottled gray color that appears light blue when seen through the water (Figure 2). Most experts recognize at least three subspecies of blue whale, *B. m. musculus*, which occurs in the Northern Hemisphere, *B. m. intermedia*, which occurs in the Southern Ocean, and *B. m. brevicauda*, a pygmy species found in the Indian Ocean and South Pacific. The blue whale was originally listed as endangered on December 2, 1970 (35 FR 18319) (Table 1).

Figure 5.1.6. Map identifying the range of the endangered blue whale.


Information available from the recovery plan (NMFS 2020a), recent stock assessment reports (Caretta et al. 2022, Hayes et al. 2020, Muto et al. 2019), and status review (NMFS 2020b) were used to summarize the life history, population dynamics and status of the species as follows.

Life History

The average life span of blue whales is eighty to ninety years. They have a gestation period of ten to twelve months, and calves nurse for six to seven months. Blue whales reach sexual maturity between five and fifteen years of age with an average calving interval of two to three years. They winter at low latitudes, where they mate, calve and nurse, and summer at high latitudes, where they feed. Blue whales forage almost exclusively on krill and can eat approximately 3,600 kilograms daily. Feeding aggregations are often found at the continental shelf edge, where upwelling produces concentrations of krill at depths of 90 to 120 m.

Population Dynamics

The following is a discussion of the species' population and its variance over time. This section includes abundance, population growth rate, genetic diversity, and spatial distribution as it relates to the blue whale.

The global, pre-exploitation estimate for blue whales is approximately 181,200 (IWC 2007). Current estimates indicate approximately 5,000 to 12,000 blue whales globally (IWC 2007). Blue whales are separated into populations by ocean basin in the North Atlantic, North Pacific, and Southern Hemisphere. There are three stocks of blue whales designated in U.S. waters: the eastern North Pacific (current best estimate $N = 1,647$ $N_{min} = 1,551$; (Calambokidis and Barlow 2013)) central North Pacific ($N = 81$ $N_{min} = 38$), and western North Atlantic ($N = 400$ to 600 $N_{min} = 440$). The Southern Hemisphere ocean basins have approximately 2,000 individual blue whales.

Current estimates indicate a growth rate of just under three percent per year for the eastern North Pacific stock (Calambokidis et al. 2009). An overall population growth rate for the species or growth rates for the two other individual U.S. stocks are not available at this time.

Little genetic data exist on blue whales globally. Data from Australia indicates that at least populations in this region experienced a recent genetic bottleneck, likely the result of commercial whaling, although genetic diversity levels appear to be similar to other, non-threatened mammal species (Attard et al. 2010). Consistent with this, data from Antarctica also demonstrate this bottleneck but high haplotype diversity, which may be a consequence of the recent timing of the bottleneck and blue whales long lifespan (Sremba et al. 2012). Data on genetic diversity of blue whales in the Northern Hemisphere are currently unavailable. However, genetic diversity information for similar cetacean population sizes can be applied. Stocks that have a total population size of 2,000 to 2,500 individuals or greater provide for maintenance of genetic diversity resulting in long-term persistence and protection from substantial environmental variance and catastrophes. Stocks that have a total population of 500 individuals or less may be at a greater risk of extinction due to genetic risks resulting from inbreeding. Stock populations at low densities (<100) are more likely to suffer from the 'Allee' effect, where inbreeding and the heightened difficulty of finding mates reduces the population growth rate in proportion with reducing density.

In general, distribution is driven largely by food requirements; blue whales are more likely to occur in waters with dense concentrations of their primary food source, krill. While they can be found in coastal waters, they are thought to prefer waters further offshore (Figure 1). In the North Atlantic Ocean, the blue whale range extends from the subtropics to the Greenland Sea.

They are most frequently sighted in waters off eastern Canada with a majority of sightings taking place in the Gulf of St. Lawrence. In the North Pacific Ocean, blue whales range from Kamchatka to southern Japan in the west and from the Gulf of Alaska and California to Costa Rica in the east. They primarily occur off the Aleutian Islands and the Bering Sea. In the northern Indian Ocean, there is a "resident" population of blue whales with sightings being reported from the Gulf of Aden, Persian Gulf, Arabian Sea, and across the Bay of Bengal to Burma and the Strait of Malacca. In the Southern Hemisphere, distributions of subspecies (*B. m. intermedia* and *B. m. brevicauda*) seem to be segregated. The subspecies *B. m. intermedia* occurs in relatively high latitudes south of the "Antarctic Convergence" (located between 48°S and 61°S latitude) and close to the ice edge. The subspecies *B. m. brevicauda* is typically distributed north of the Antarctic Convergence.

Status

The blue whale is endangered as a result of past commercial whaling. In the North Atlantic, at least 11,000 blue whales were taken from the late nineteenth to mid-twentieth centuries. In the North Pacific, at least 9,500 whales were killed between 1910 and 1965. Commercial whaling no longer occurs; potential threats to blue whales identified in the 2020 Recovery Plan include ship strikes, entanglement in fishing gear and marine debris, anthropogenic noise, and loss of prey base due to climate and ecosystem change (NMFS 2020). There are no recent confirmed records of anthropogenic mortality or serious injury to blue whales in the U.S. Atlantic EEZ or in Atlantic Canadian waters (Henry et al. 2020). The total level of human caused mortality and serious injury is unknown, but it is believed to be insignificant and approaching a zero mortality and serious injury rate (Hayes et al. 2020). Because populations appear to be increasing in size, the species appears to be somewhat resilient to current threats; however, the species has not recovered to pre-exploitation levels.

The 2020 5-Year Review for Blue Whales states that there is insufficient data to undertake an assessment of the blue whale's current status on a global scale. As none of the recovery criteria outlined in the Revised Recovery Plan have been met and given the existing data gaps, the recommendation was for blue whales to remain classified as endangered.

Critical Habitat

No critical habitat has been designated for the blue whale.

Recovery Goals

The goal of the 2020 Revised Recovery Plan is to promote the recovery of blue whales to the point at which they can be removed from the List of Endangered and Threatened Wildlife and Plants under the provisions of the ESA. The intermediate goal is to reach a sufficient recovery status to reclassify the species from endangered to threatened. The two main objectives for blue whales are to 1) increase blue whale resiliency and ensure geographic and ecological representation by achieving sufficient and viable populations in all ocean basins and in each recognized subspecies, and 2) increase blue whale resiliency by managing or eliminating significant anthropogenic threats. The Recovery Plan includes recovery criteria that address minimum abundance in each of the nine management units (abundance of 500 or 2,000 whales depending on the unit); stable or increasing trend in each of the nine management units; and criteria related to threat identification and minimization (NMFS 2020). The Recovery Plan also includes delisting criteria that address abundance, trends, and threat minimization/elimination (NMFS 2020).

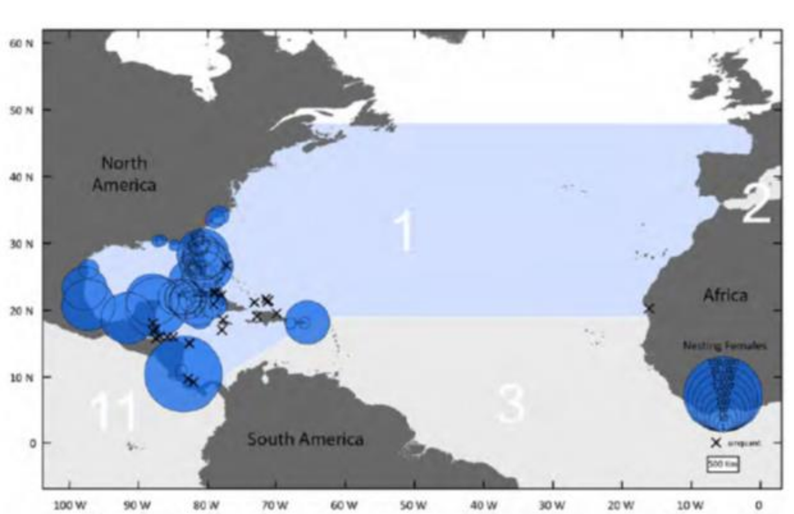
5.2 Sea Turtles

Kemp's ridley and leatherback sea turtles are currently listed under the ESA at the species level; green and loggerhead sea turtles are listed at the DPS level. Therefore, we include information on the range-wide status of Kemp's ridley and leatherback sea turtles to provide the overall status of each species. Information on the status of loggerhead and green sea turtles is for the DPS affected by this action.

5.2.1 Green Sea Turtle (North Atlantic DPS)

The green sea turtle has a circumglobal distribution, occurring throughout tropical, subtropical and, to a lesser extent, temperate waters. They commonly inhabit nearshore and inshore waters. It is the largest of the hardshell marine turtles, growing to a weight of approximately 350 lbs. (159 kg) and a straight carapace length of greater than 3.3 ft. (1 m). The species was listed under the ESA on July 28, 1978 (43 FR 32800) as endangered for breeding populations in Florida and the Pacific coast of Mexico and threatened in all other areas throughout its range. On April 6, 2016, NMFS listed 11 DPSs of green sea turtles as threatened or endangered under the ESA (81 FR 20058). The North Atlantic DPS of green turtle is found in the North Atlantic Ocean and Gulf of Mexico (Figure 5.2.1) and is listed as threatened. Green turtles from the North Atlantic DPS range from the boundary of South and Central America (7.5° N, 77° W) in the south, throughout the Caribbean, the Gulf of Mexico, and the U.S. Atlantic coast to New Brunswick, Canada (48° N, 77° W) in the north. The range of the DPS then extends due east along latitudes 48° N and 19° N to the western coasts of Europe and Africa.

Figure 5.2.1. Range of the North Atlantic distinct population segment green turtle (1), with location and abundance of nesting females (Seminoff et al. 2015).



We used information available in the 2015 Status Review (Seminoff et al. 2015), relevant literature, and recent nesting data from the Florida Fish and Wildlife Conservation Commission's Fish and Wildlife Research Institute (FWRI) to summarize the life history, population dynamics and status of the species, as follows.

Life History

Costa Rica (Tortuguero), Mexico (Campeche, Yucatan, Quintana Roo), United States (Florida) and Cuba support nesting concentrations of particular interest in the North Atlantic DPS (Seminoff et al. 2015). The largest nesting site in the North Atlantic DPS is in Tortuguero, Costa Rica, which hosts 79% of nesting females for the DPS (Seminoff et al. 2015). In the southeastern United States, females generally nest between May and September (Seminoff et al. 2015, Witherington et al. 2006). Green sea turtles lay an average of three nests per season with an average of one hundred eggs per nest (Hirth 1997, Seminoff et al. 2015). The remigration interval (period between nesting seasons) is two to five years (Hirth 1997, Seminoff et al. 2015). Nesting occurs primarily on beaches with intact dune structure, native vegetation, and appropriate incubation temperatures during the summer months.

Sea turtles are long-lived animals. Size and age at sexual maturity have been estimated using several methods, including mark-recapture, skeletochronology, and marked known-aged individuals. Skeletochronology analyzes growth marks in bones to obtain growth rates and age at sexual maturity estimates. Estimates vary widely among studies and populations, and methods continue to be developed and refined (Avens and Snover 2013). Early mark-recapture studies in Florida estimated the age at sexual maturity 18-30 years (Frazer and Ehrhart 1985, Goshe et al. 2010, Mendonça 1981). More recent estimates of age at sexual maturity are as high as 35–50 years (Avens and Snover 2013, Goshe et al. 2010), with lower ranges reported from known age (15–19 years) turtles from the Cayman Islands (Bell et al. 2005) and Caribbean Mexico (12–20 years) (Zurita et al. 2012). A study of green turtles that use waters of the southeastern United States as developmental habitat found the age at sexual maturity likely ranges from 30 to 44 years (Goshe et al. 2010). Green turtles in the Northwestern Atlantic mature at 2.8-33+ ft. (85–100+ cm) straight carapace lengths (SCL) (Avens and Snover 2013).

Adult turtles exhibit site fidelity and migrate hundreds to thousands of kilometers from nesting beaches to foraging areas. Green sea turtles spend the majority of their lives in coastal foraging grounds, which include open coastlines and protected bays and lagoons. Adult green turtles feed primarily on seagrasses and algae, although they also eat other invertebrate prey (Seminoff et al. 2015).

Population Dynamics

The North Atlantic DPS has a globally unique haplotype, which was a factor in defining the discreteness of the DPS. Evidence from mitochondrial DNA studies indicates that there are at least four independent nesting subpopulations in Florida, Cuba, Mexico, and Costa Rica (Seminoff et al. 2015). More recent genetic analysis indicates that designating a new western Gulf of Mexico management unit might be appropriate (Shamblin et al. 2016).

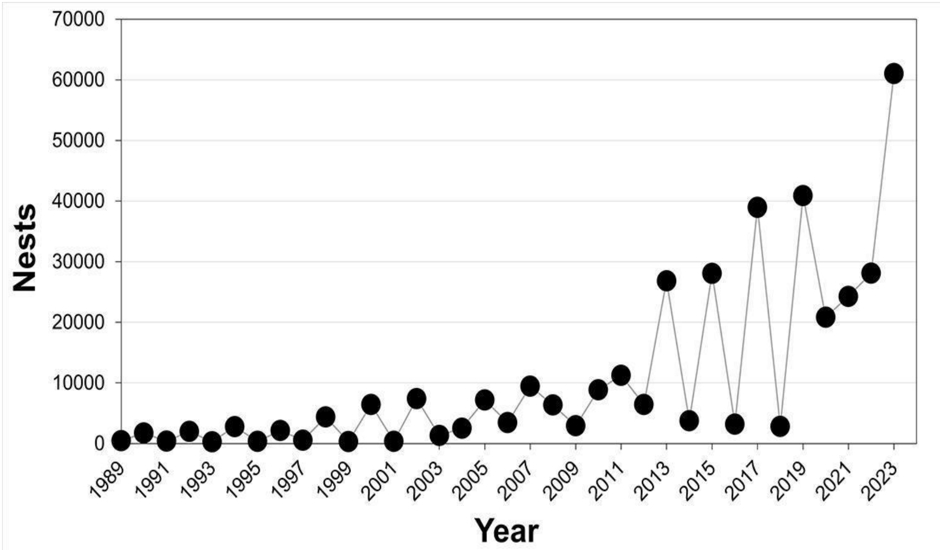
Compared to other DPSs, the North Atlantic DPS exhibits the highest nester abundance, with approximately 167,424 females at seventy-three nesting sites (using data through 2012), and available data indicated an increasing trend in nesting (Seminoff et al. 2015). Counts of nests and nesting females are commonly used as an index of abundance and population trends, even though there are doubts about the ability to estimate the overall population size.

There are no reliable estimates of population growth rate for the DPS as a whole, but estimates have been developed at a localized level. The status review for green sea turtles assessed population trends for seven nesting sites with more 10 years of data collection in the North Atlantic DPS. The results were variable with some sites showing no trend and others increasing. However, all major nesting populations (using data through 2011-2012) demonstrated increases in abundance (Seminoff et al. 2015).

Recent data is available for the southeastern United States. The FWRI monitors sea turtle nesting through the Statewide Nesting Beach Survey (SNBS) and Index Nesting Beach Survey (INBS). Since 1979, the SNBS had surveyed approximately 215 beaches to collect information on the distribution, seasonality, and abundance of sea turtle nesting in Florida. Since 1989, the INBS has been conducted on a subset of SNBS beaches to monitor trends through consistent effort and specialized training of surveyors. The INBS data uses a standardized data-collection protocol to allow for comparisons between years and is presented for green, loggerhead, and leatherback sea turtles. The index counts represent 27 core index beaches and do not represent Florida's total annual nest counts because they are collected only on a subset of Florida's beaches (27 out of 224 beaches) and only during a 109-day time window (15 May through 31 August). The index nest counts represent approximately 67% of known green turtle nesting in Florida (https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/).

Green turtle nest counts have increased 120-fold since standardized nest counts began in 1989 (less than 300 nests recorded in 1989). In 2023, green turtle nest counts on the 27-core index beaches reached more than 61,000 nests recorded. Nesting green turtles tend to follow a two-year reproductive cycle and, typically, there are wide year-to-year fluctuations in the number of nests recorded. Green turtles set record highs in 2011, 2013, 2015, 2017, 2019, and 2023. Numbers show a mostly biennial pattern of fluctuation.

Figure 5.2.2. Number of green sea turtle nests counted on core index beaches in Florida from 1989-2023 (source: https://myfwc.com/media/sy5ey5jq/greenturtlenests.jpg)



Status
Historically, green sea turtles in the North Atlantic DPS were hunted for food, which was the principle cause of the population's decline. Apparent increases in nester abundance for the North Atlantic DPS in recent years are encouraging but must be viewed cautiously, as the datasets represent a fraction of a green sea turtle generation, which is between 30 and 40 years (Seminoff et al. 2015). While the threats of pollution, habitat loss through coastal development, beachfront lighting, and fisheries bycatch continue, the North Atlantic DPS appears to be somewhat resilient to future perturbations.

Critical Habitat
Critical habitat in effect for the North Atlantic DPS of green sea turtles surrounds Culebra Island, Puerto Rico (66 FR 20058, April 6, 2016), which is outside the action area. On July 19, 2023, NMFS published a proposed rule (88 FR 46572) to designate specific areas in the marine environment as critical habitat for six DPSs of the green sea turtle, including the North Atlantic DPS. The proposed critical habitat does not overlap with the action area.

Recovery Goals
The most recent Recovery Plan for the U.S. population of green sea turtles in the Atlantic was published in 1991. The goal of the 1991 Recovery Plan for the U.S. population of green sea turtles is delist the species once the recovery criteria are met (NMFS and U.S.FWS 1991). The recovery plan includes criteria for delisting related to nesting activity, nesting habitat protection, and reduction in mortality.

Priority actions to meet the recovery goals include:

1. Providing long-term protection to important nesting beaches.
2. Ensuring at least a 60% hatch rate success on major nesting beaches.
3. Implementing effective lighting ordinances/plans on nesting beaches.
4. Determining distribution and seasonal movements of all life stages in the marine environment.
5. Minimizing commercial fishing mortality.

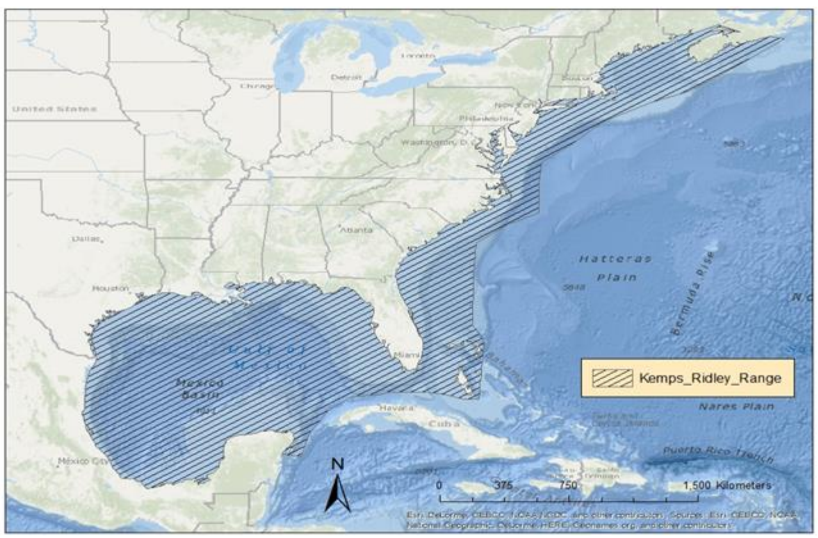
6. Reducing threat to the population and foraging habitat from marine pollution.

5.2.2 Kemp's Ridley Sea Turtle

The range of Kemp's ridley sea turtles extends from the Gulf of Mexico to the Atlantic coast (Figure 5.2.3). They have occasionally been found in the Mediterranean Sea, which may be due to migration expansion or increased hatchling production (Tomás and Raga 2008). They are the smallest of all sea turtle species, with a nearly circular top shell and a pale yellowish bottom shell. The species was first listed under the Endangered Species Conservation Act (35 FR 18319, December 2, 1970) in 1970. The species has been listed as endangered under the ESA since 1973.

We used information available in the revised recovery plan (NMFS et al. 2011), the five-year review (NMFS and USFWS 2015), and published literature to summarize the life history, population dynamics and status of the species, as follows.

Figure 5.2.3. Range of the Kemp's ridley sea turtle



Life History

Kemp's ridley nesting is essentially limited to the western Gulf of Mexico. Approximately 97% of the global population's nesting activity occurs on a 90-mile (146-km) stretch of beach that includes Rancho Nuevo in Mexico (Wibbels and Bevan 2019). In the United States, nesting occurs primarily in Texas and occasionally in Florida, Alabama, Georgia, South Carolina, and North Carolina (NMFS and USFWS 2015). Nesting occurs from April to July in large arribadas (synchronized large-scale nesting). The average remigration interval is two years, although intervals of 1 and 3 years are not uncommon (NMFS et al. 2011, TEWG 1998, 2000). Females lay an average of 2.5 clutches per season (NMFS et al. 2011). The annual average clutch size is 95 to 112 eggs per nest (NMFS and USFWS 2015). The nesting location may be particularly important because hatchlings can more easily migrate to foraging grounds in deeper oceanic waters, where they remain for approximately two years before returning to nearshore coastal habitats (Epperly et al. 2013, NMFS and USFWS 2015, Snover et al. 2007). Modeling indicates that oceanic-stage Kemp's ridley turtles are likely distributed throughout the Gulf of Mexico into the northwestern Atlantic (Putman et al. 2013). Kemp's ridley nearing the age when recruitment to nearshore waters occurs are more likely to be distributed in the northern Gulf of Mexico, eastern Gulf of Mexico, and the western Atlantic (Putman et al. 2013).

Several studies, including those of captive turtles, recaptured turtles of known age, mark-recapture data, and skeletochronology, have estimated the average age at sexual maturity for Kemp's ridleys between 5 to 12 years (captive only) (Bjorndal et al. 2014), 10 to 16 years (Chaloupka and Zug 1997, Schmid and Witzell 1997, Schmid and Woodhead 2000, Zug et al. 1997), 9.9 to 16.7 years (Snover et al. 2007), 10 and 18 years (Shaver and Wibbels 2007), 6.8 to 21.8 years (mean 12.9 years) (Avens et al. 2017).

During spring and summer, juvenile Kemp's ridleys generally occur in the shallow coastal waters of the northern Gulf of Mexico from south Texas to north Florida and along the U.S. Atlantic coast from southern Florida to the Mid-Atlantic and New England. In addition, the NEFSC caught a juvenile Kemp's ridley during a recent research project in deep water south of Georges Bank (NEFSC, unpublished data). In the fall, most Kemp's ridleys migrate to deeper or more southern, warmer waters and remain there through the winter. As adults, many turtles remain in the Gulf of Mexico, with only occasional occurrence in the Atlantic Ocean (NMFS et al. 2011). Adult habitat largely consists of sandy and muddy areas in shallow, nearshore waters less than 120 feet (37 meters) deep (Seney and Landry 2008, Shaver et al. 2005, Shaver and Rubio 2008), although they can also be found in deeper offshore waters. As larger juveniles and adults, Kemp's ridleys forage on swimming crabs, fish, mollusks, and tunicates (NMFS et al. 2011).

Population Dynamics

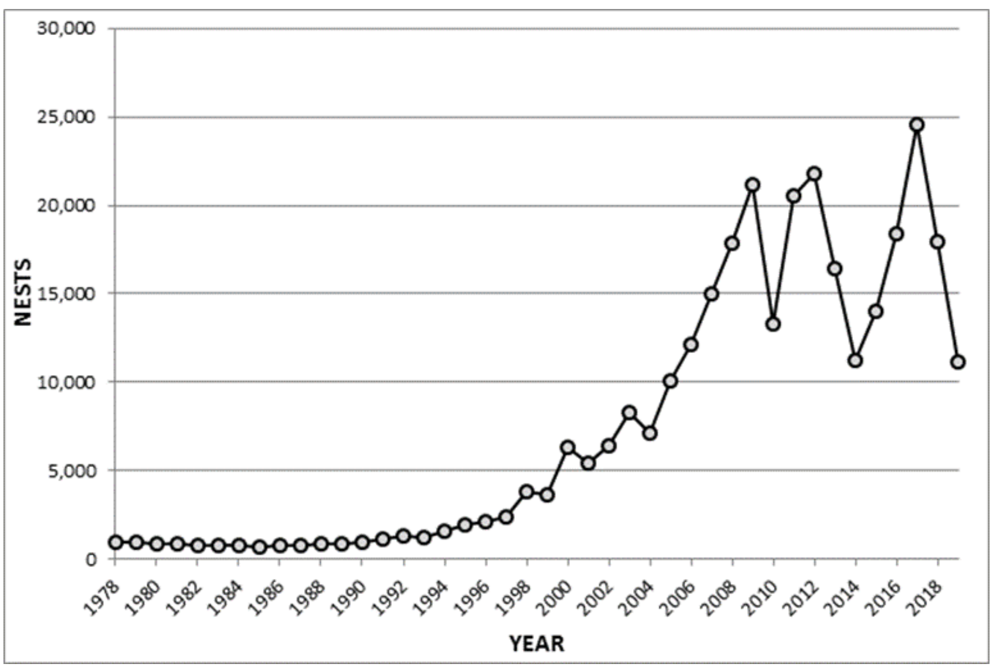
Of the sea turtles species in the world, the Kemp's ridley has declined to the lowest population level. Nesting aggregations at a single location (Rancho Nuevo, Mexico) were estimated at 40,000 females in 1947. By the mid-1980s, the population had declined to an estimated 300 nesting females. From 1980 to 2003, the number of nests at three primary nesting beaches (Rancho Nuevo, Tepehuajes, and Playa Dos) increased at 15% annually (Heppell et al. 2005). However, due to recent declines in nest counts, decreased survival of immature and adult sea turtles, and updated population modeling, this rate is not expected to continue and the overall trend is unclear (Caillouet et al. 2018, NMFS and USFWS 2015). In 2019, there were 11,090 nests, a 37.61% decrease from 2018, and a 54.89% decrease from 2017, which had the highest number (24,587) of nests (Figure 5.2.4; unpublished data). The reason for this recent decline is uncertain. In 2021, 198 Kemp's ridley nests were found in Texas – the largest number recorded in Texas since 1978 was in 2017, when 353 nests were documented.

Using the standard IUCN protocol for sea turtle assessments, the number of mature individuals was recently estimated at 22,341 (Wibbels and Bevan 2019). The calculation took into account the average annual nests from 2016-2018 (21,156), a clutch frequency of 2.5 per year, a remigration interval of 2 years, and a sex ratio of 3.17 females: 1 male. Based on the data in their analysis, the assessment concluded the current population trend is unknown (Wibbels and Bevan 2019). Genetic variability in Kemp's ridley turtles is considered to be high, as measured by nuclear DNA analyses (i.e., microsatellites) (NMFS et al. 2011). If this holds true, rapid increases in population over one or two generations would likely prevent any negative consequences in the genetic variability of the species (NMFS et al. 2011). Additional analysis of the mtDNA taken from samples of Kemp's ridley turtles at Padre Island, Texas, showed six distinct haplotypes, with one found at both Padre Island and Rancho Nuevo (Dutton et al. 2006).

Status

The Kemp's ridley was listed as endangered at the species level in response to a severe population decline, primarily the result of egg collection. In 1973, legal ordinances in Mexico prohibited the harvest of sea turtles from May to August, and in 1990, the harvest of all sea turtles was prohibited by presidential decree. In 2002, Rancho Nuevo was declared a Sanctuary. Nesting beaches in Texas have been re-established. Fishery interactions are the main threat to the species. Other threats include habitat destruction, oil spills, dredging, disease, cold stunning, and climate change. The current population trend is uncertain. While the population has increased, recent nesting numbers have been variable. In addition, the species' limited range and low global abundance make it vulnerable to new sources of mortality as well as demographic and environmental randomness, all of which are often difficult to predict with any certainty. Therefore, its resilience to future perturbation is low.

Figure 5.2.4. Kemp's ridley nest totals from Mexican beaches (Gladys Porter Zoo nesting database 2019)



Critical Habitat

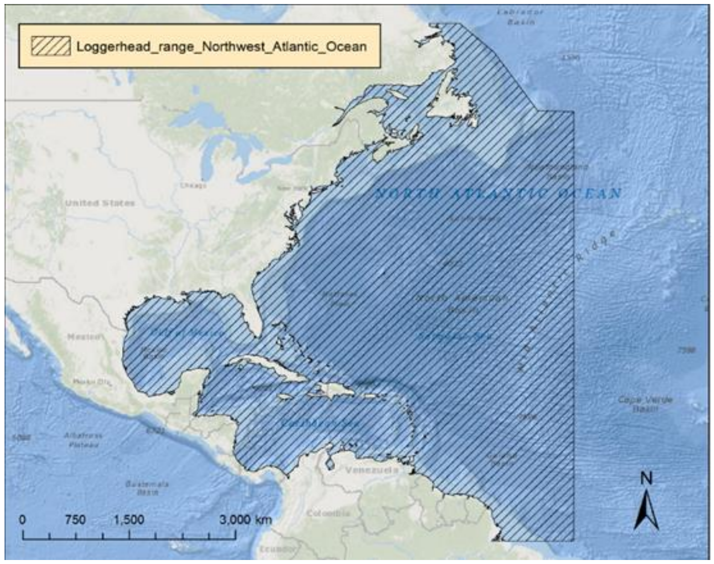
Critical habitat has not been designated for Kemp's ridley sea turtles.

Recovery Goals
As with other recovery plans, the goal of the 2011 Kemp's ridley recovery plan (NMFS, USFWS, and SEMARNAT 2011) is to conserve and protect the species so that the listing is no longer necessary. The recovery criteria relate to the number of nesting females, hatchling recruitment, habitat protection, social and/or economic initiatives compatible with conservation, reduction of predation, TED or other protective measures in trawl gear, and improved information available to ensure recovery. In 2015, the bi-national recovery team published a number of recommendations including four critical actions (NMFS and USFWS 2015). These include: (a) continue funding by the major funding institutions at a level of support needed to run the successful turtle camps in the State of Tamaulipas, Mexico, in order to continue the high level of hatchling production and nesting female protection; (b) increase turtle excluder device (TED) compliance in U.S. and MX shrimp fisheries; 3 (c) require TEDs in U.S. skimmer trawl fisheries and other trawl fisheries in coastal waters where fishing overlaps with the distribution of Kemp's ridleys; (d) assess bycatch in gillnets in the Northern Gulf of Mexico and State of Tamaulipas, Mexico, to determine whether modifications to gear or fishing practices are needed.

The most recent Five-Year Review was completed in 2015 (NMFS and USFWS 2015) with a recommendation that the status of Kemp's ridley sea turtles should remain as endangered. In the Plan, the Services recommend that efforts continue towards achieving the major recovery actions in the 2015 plan with a priority for actions to address recent declines in the annual number of nests.

5.2.3 Loggerhead Sea Turtle (Northwest Atlantic Ocean DPS)
Loggerhead sea turtles are circumglobal and are found in the temperate and tropical regions of the Indian, Pacific, and Atlantic Oceans. The loggerhead sea turtle is distinguished from other turtles by its reddish-brown carapace, large head and powerful jaws. The species was first listed as threatened under the Endangered Species Act in 1978 (43 FR 32800, July 28, 1978). On September 22, 2011, the NMFS and USFWS designated nine distinct population segments of loggerhead sea turtles, with the Northwest Atlantic Ocean DPS listed as threatened (76 FR 58868). The Northwest Atlantic Ocean DPS of loggerheads is found along eastern North America, Central America, and northern South America (Figure 5.2.5).

Figure 5.2.5. Range of the Northwest Atlantic Ocean DPS of loggerhead sea turtles



We used information available in the 2009 Status Review (Conant et al. 2009), the final listing rule (76 FR 58868, September 22, 2011), the relevant literature, and recent nesting data from the FWRI to summarize the life history, population dynamics and status of the species, as follows.

Life History

Nesting occurs on beaches where warm, humid sand temperatures incubate the eggs. Northwest Atlantic females lay an average of five clutches per year. The annual average clutch size is 115 eggs per nest. Females do not nest every year. The average remigration interval is three years. There is a 54% emergence success rate (Conant et al. 2009). As with other sea turtles, temperature determines the sex of the turtle during the middle of the incubation period. Turtles spend the post-hatchling stage in pelagic waters. The juvenile stage is spent first in the oceanic zone and later in coastal waters. Some juveniles may periodically move between the oceanic zone and coastal waters (Bolten 2003, Conant et al. 2009, Mansfield 2006, Morreale and Standora 2005, Witzell 2002). Coastal waters provide important foraging, inter-nesting, and migratory habitats for adult loggerheads. In both the oceanic zone and coastal waters, loggerheads are primarily carnivorous, although they do consume some plant matter as well (Conant et al. 2009). Loggerheads have been documented to feed on crustaceans, mollusks, jellyfish and salps, and algae (Bjorndal 1997, Donaton et al. 2019, Seney and Musick 2007). Avens et al. (2015) used three approaches to estimate age at maturation. Mean age predictions associated with minimum and mean maturation straight carapace lengths were 22.5-25 and 36-38 years for females and 26-28 and 37-42 years for males. Male and female sea turtles have similar post-maturation longevity, ranging from 4 to 46 (mean 19) years (Avens et al. 2015).

Loggerhead hatchlings from the western Atlantic disperse widely, most likely using the Gulf Stream to drift throughout the Atlantic Ocean. MtDNA evidence demonstrates that juvenile loggerheads from southern Florida nesting beaches comprise the vast majority (71%-88%) of individuals found in foraging grounds throughout the western and eastern Atlantic: Nicaragua, Panama, Azores and Madeira, Canary Islands and Andalusia, Gulf of Mexico, and Brazil (Masuda 2010). LaCasalla et al. (2013) found that loggerheads, primarily juveniles, caught within the Northeast Distant (NED) waters of the North Atlantic mostly originated from nesting populations in the southeast United States and, in particular, Florida. They found that nearly all loggerheads caught in the NED came from the Northwest Atlantic DPS (mean = 99.2%), primarily from the large eastern Florida rookeries. There was little evidence of contributions from the South Atlantic, Northeast Atlantic, or Mediterranean DPSs (LaCasalla et al. 2013). A more recent analysis assessed sea turtles captured in fisheries in the Northwest Atlantic and included samples from 850 (including 24 turtles caught during fisheries research) turtles caught from 2000-2013 in coastal and oceanic habitats (Stewart et al. 2019). The turtles were primarily captured in pelagic longline and bottom otter trawls. Other gears included bottom longline, hook and line, gillnet, dredge, and dip net. Turtles were identified from 19 distinct management units; the western Atlantic nesting populations were the main contributors with little representation from the Northeast Atlantic, Mediterranean, or South Atlantic DPSs (Stewart et al. 2019). There was a significant split in the distribution of small (≤ 2 ft. (63 cm) SCL) and large (> 2 ft. (63 cm) SCL) loggerheads north and south of Cape Hatteras, North Carolina. North of Cape Hatteras, large turtles came mainly from southeast Florida (44%±15%) and the northern United States management units (33%±16%); small turtles came from central east Florida (64%±14%). South of Cape Hatteras, large turtles came mainly from central east Florida (52%±20%) and southeast Florida (41%±20%); small turtles came from southeast Florida (56%±25%). The authors concluded that bycatch in the western North Atlantic would affect the Northwest Atlantic DPS almost exclusively (Stewart et al. 2019).

Population Dynamics

A number of stock assessments and similar reviews (Conant et al. 2009, Heppell et al. 2005, SEFSC 2001, 2009, Richards et al. 2011, TEWG 1998, 2000, 2009) have examined the stock status of loggerheads in the Atlantic Ocean, but none has been able to develop a reliable estimate of absolute population size. As with other species, counts of nests and nesting females are commonly used as an index of abundance and population trends, even though there are doubts about the ability to estimate the overall population size.

Based on genetic analysis of nesting subpopulations, the Northwest Atlantic Ocean DPS is divided into five recovery units: Northern, Peninsular Florida, Dry Tortugas, Northern Gulf of Mexico, and Greater Caribbean (Conant et al. 2009). A more recent analysis using expanded mtDNA sequences revealed that rookeries from the Gulf and Atlantic coasts of Florida are genetically distinct (Shamblin et al. 2014). The recent genetic analyses suggest that the Northwest Atlantic Ocean DPS should be considered as ten management units: (1) South Carolina and Georgia, (2) central eastern Florida, (3) southeastern Florida, (4) Cay Sal, Bahamas, (5) Dry Tortugas, Florida, (6) southwestern Cuba, (7) Quintana Roo, Mexico, (8) southwestern Florida, (9) central western Florida, and (10) northwestern Florida (Shamblin et al. 2012). The Northwest Atlantic Ocean's loggerhead nesting aggregation is considered the largest in the world (Casale and Tucker 2017). Using data from 2004-2008, the adult female population size of the DPS was estimated at 20,000 to 40,000 females (SEFSC 2009). More recently, Ceriani and Meylan (2017) reported a 5-year average (2009-2013) of more than 83,717 nests per year in the southeast United States and Mexico (excluding Cancun (Quintana Roo, Mexico). These estimates included sites without long-term (≥10 years) datasets. When they used data from 86 index sites (representing 63.4% of the estimated nests for the whole DPS with long-term datasets, they reported 53,043 nests per year. Trends at the different index nesting beaches ranged from negative to positive. In a trend analysis of the 86 index sites, the overall trend for the Northwest Atlantic DPS was positive (+2%) (Ceriani and Meylan 2017). Uncertainties in this analysis include, among others, using nesting females as proxies for overall population abundance and trends, demographic parameters, monitoring methodologies, and evaluation methods involving simple comparisons of early and later 5-year average annual nest counts. However, the authors concluded that the subpopulation is well monitored and the data evaluated represents 63.4 % of the total estimated annual nests of the subpopulation and, therefore, are representative of the overall trend (Ceriani and Meylan 2017).

About 80% of loggerhead nesting in the southeast United States occurs in six Florida counties (NMFS and USFWS 2008). The Peninsula Florida Recovery Unit and the Northern Recovery Unit represent approximately 87% and 10%, respectively of all nesting effort in the Northwest Atlantic DPS (Ceriani and Meylan 2017, NMFS and USFWS 2008). As described above, FWRI's INBS collects standardized nesting data. The index nest counts for loggerheads represent approximately 53% of known nesting in Florida. There have been three distinct intervals observed: increasing (1989-1998), decreasing (1998-2007), and increasing (2007-2023) and an overall stable trend over the monitored time period (1989-2023). At core index beaches in Florida, nesting totaled a minimum of 28,876 nests in 2007 and a maximum of 70,945 nests in 2023 (https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/). The nest counts in Figure 5.2.6 represent peninsular Florida and do not include an additional set of beaches in the Florida Panhandle and southwest coast that were added to the program in 1997 and more recent years. Nest counts at these Florida Panhandle index beaches have an upward trend since 2010 (Figure 5.2.7).

Figure 5.2.6. Annual nest counts of loggerhead sea turtles on Florida core index beaches in peninsular Florida, 1989-2023 (source: https://myfwc.com/media/wwded1gr/loggerheadnests.jpg)

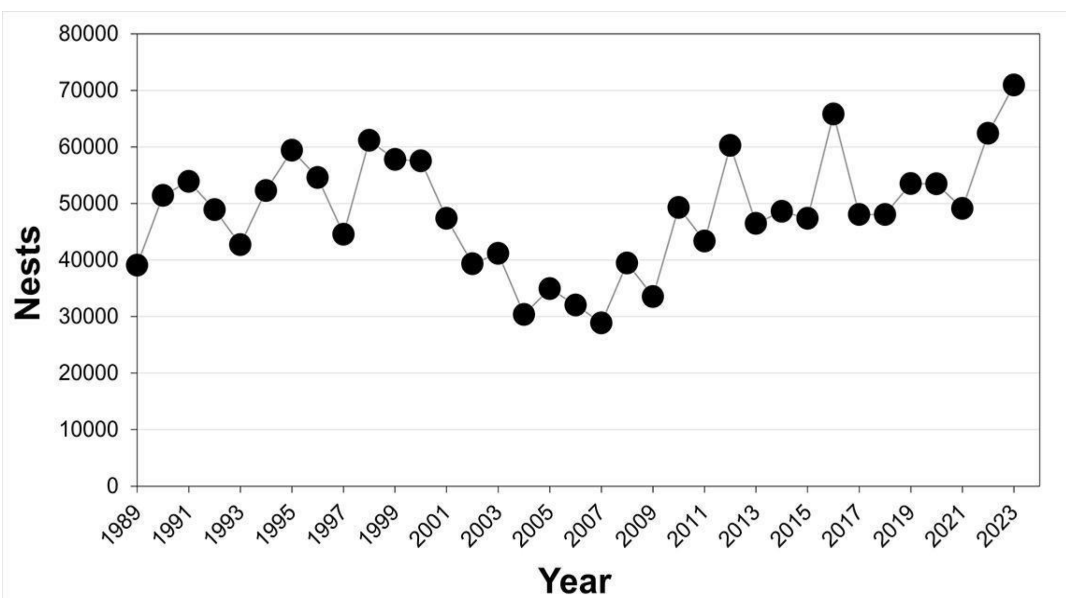
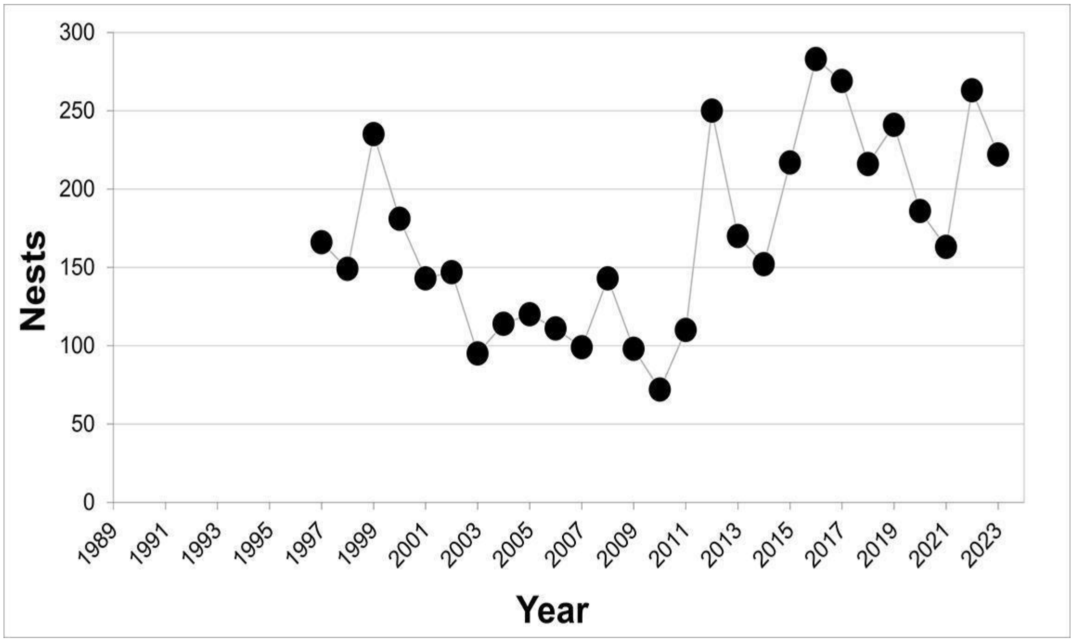


Figure 5.2.7. Annual nest counts of loggerhead sea turtles on index beaches in the Florida Panhandle, 1997-2023 (source: https://myfwc.com/media/ewydvgtl/loggerhead-nests-panhandle.jpg)



The annual nest counts on Florida's index beaches fluctuate widely, and we do not fully understand what drives these fluctuations. In assessing the population, Ceriani and Meylan (2017) and Bolten et al. (2019) looked at trends by recovery unit. Trends by recovery unit were variable.

The Peninsular Florida Recovery Unit extends from the Georgia-Florida border south and then north (excluding the islands west of Key West, Florida) through Pinellas County on the west coast of Florida. Annual nest counts from 1989 to 2018 ranged from a low of 28,876 in 2007 to a high of 65,807 in 1998 (Bolten et al. 2019). More recently (2008-2018), counts have ranged from 33,532 in 2009 to 65,807 in 2016 (Bolten et al. 2019). Nest counts taken at index beaches in Peninsular Florida showed a significant decline in loggerhead nesting from 1989 to 2007, most likely attributed to mortality of oceanic-stage loggerheads caused by fisheries bycatch (Witherington et al. 2009). Trend analyses have been completed for various periods. From 2009 through 2013, a 2% decrease for this recovery unit was reported (Ceriani and Meylan 2017). Using a longer time series from 1989-2018, there was no significant change in the number of annual nests (Bolten et al. 2019). It is important to recognize that an increase in the number of nests has been observed since 2007. The recovery team cautions that using short term trends in nesting abundance can be misleading and trends should be considered in the context of one generation (50 years for loggerheads) (Bolten et al. 2019).

The Northern Recovery Unit, ranging from the Florida-Georgia border through southern Virginia, is the second largest nesting aggregation in the DPS. Annual nest totals for this recovery unit from 1983 to 2019 have ranged from a low of 520 in 2004 to a high of 5,555 in 2019 (Bolten et al. 2019). From 2008 to 2019, counts have ranged from 1,289 nests in 2014 to

5,555 nests in 2019 (Bolten et al. 2019). Nest counts at loggerhead nesting beaches in North Carolina, South Carolina, and Georgia declined at 1.9% annually from 1983 to 2005 (NMFS and USFWS 2008). Recently, the trend has been increasing. Ceriani and Meylan (2017) reported a 35% increase for this recovery unit from 2009 through 2013. A longer-term trend analysis based on data from 1983 to 2019 indicates that the annual rate of increase is 1.3% (Bolten et al. 2019). The Dry Tortugas Recovery Unit includes all islands west of Key West, Florida. A census on Key West from 1995 to 2004 (excluding 2002) estimated a mean of 246 nests per year, or about 60 nesting females (NMFS and USFWS 2008). No trend analysis is available because there was not an adequate time series to evaluate the Dry Tortugas recovery unit (Ceriani et al. 2019, Ceriani and Meylan 2017), which accounts for less than 1% of the Northwest Atlantic DPS (Ceriani and Meylan 2017).

The Northern Gulf of Mexico Recovery Unit is defined as loggerheads originating from beaches in Franklin County on the northwest Gulf coast of Florida through Texas. From 1995 to 2007, there were an average of 906 nests per year on approximately 300 km of beach in Alabama and Florida, which equates to about 221 females nesting per year (NMFS and USFWS 2008). Annual nest totals for this recovery unit from 1997-2018 have ranged from a low of 72 in 2010 to a high of 283 in 2016 (Bolten et al. 2019). Evaluation of long-term nesting trends for the Northern Gulf of Mexico Recovery Unit is difficult because of changed and expanded beach coverage. However, there are now over 20 years of Florida index nesting beach survey data. A number of trend analyses have been conducted. From 1995 to 2005, the recovery unit exhibited a significant declining trend (Conant et al. 2009, NMFS and USFWS 2008). Nest numbers have increased in recent years (Bolten et al. 2019) (see https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/). In the 2009-2013 trend analysis by Ceriani and Meylan (2017), a 1% decrease for this recovery unit was reported, likely due to diminished nesting on beaches in Alabama, Mississippi, Louisiana, and Texas. A longer-term analysis from 1997-2018 found that there has been a non-significant increase of 1.7% (Bolten et al. 2019).

The Greater Caribbean Recovery Unit encompasses nesting subpopulations in Mexico to French Guiana, the Bahamas, and the Lesser and Greater Antilles. The majority of nesting for this recovery unit occurs on the Yucatán Peninsula, in Quintana Roo, Mexico, with 903 to 2,331 nests annually (Zurita et al. 2003). Other significant nesting sites are found throughout the Caribbean, including Cuba, with approximately 250 to 300 nests annually (Ehrhart et al. 2003), and over 100 nests annually in Cay Sal in the Bahamas (NMFS and USFWS 2008). In the trend analysis by Ceriani and Meylan (2017), a 53% increase for this Recovery Unit was reported from 2009 through 2013.

Status

Fisheries bycatch is the highest threat to the threatened Northwest Atlantic DPS of loggerhead sea turtles (Conant et al. 2009). Other threats include boat strikes, marine debris, coastal development, habitat loss, contaminants, disease, and climate change. Nesting trends for each of the loggerhead sea turtle recovery units in the Northwest Atlantic Ocean DPS are variable. Overall, short-term trends have shown increases, however, over the long-term the DPS is considered stable.

Critical Habitat

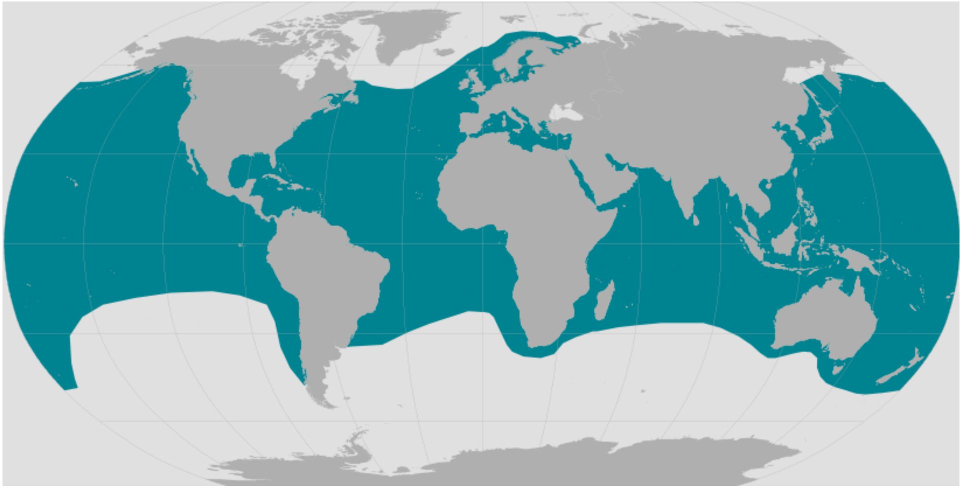
Critical habitat for the Northwest Atlantic DPS was designated in 2014 (see 79 FR 39855); this critical habitat is outside the action area

Recovery Goals
The recovery goal for the Northwest Atlantic loggerhead is to ensure that each recovery unit meets its recovery criteria alleviating threats to the species so that protection under the ESA is not needed. The recovery criteria relate to the number of nests and nesting females, trends in abundance on the foraging grounds, and trends in neritic strandings relative to in-water abundance. The 2008 Final Recovery Plan for the Northwest Atlantic Population of Loggerheads includes the complete downlisting/delisting criteria (NMFS and U.S. FWS 2008). The recovery objectives to meet these goals include:

1. Ensure that the number of nests in each recovery unit is increasing and that this increase corresponds to an increase in the number of nesting females.
2. Ensure the in-water abundance of juveniles in both neritic and oceanic habitats is increasing and is increasing at a greater rate than strandings of similar age classes.
3. Manage sufficient nesting beach habitat to ensure successful nesting.
4. Manage sufficient feeding, migratory and internesting marine habitats to ensure successful growth and reproduction.
5. Eliminate legal harvest.
6. Implement scientifically based nest management plans.
7. Minimize nest predation.
8. Recognize and respond to mass/unusual mortality or disease events appropriately.
9. Develop and implement local, state, federal and international legislation to ensure long-term protection of loggerheads and their terrestrial and marine habitats.
10. Minimize bycatch in domestic and international commercial and artisanal fisheries.
11. Minimize trophic changes from fishery harvest and habitat alteration.
12. Minimize marine debris ingestion and entanglement.
13. Minimize vessel strike mortality.

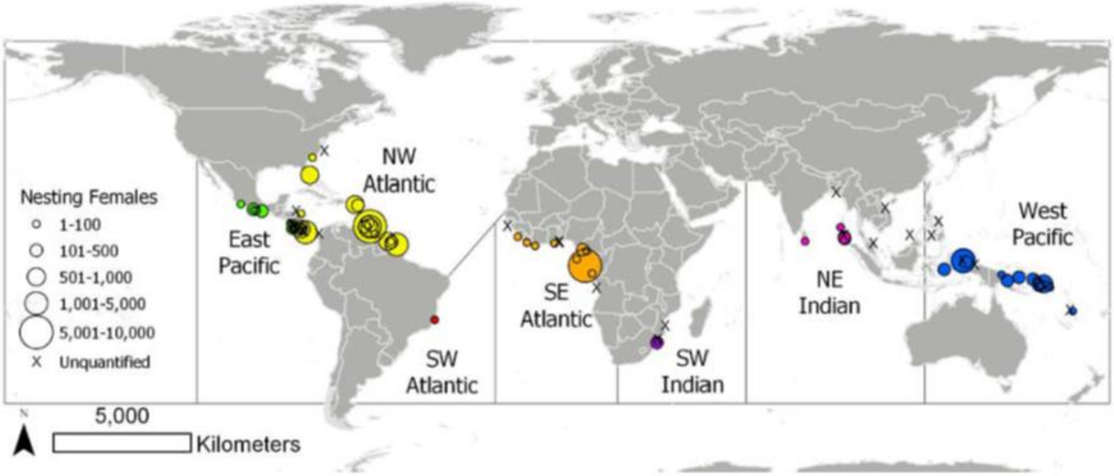
5.2.4 Leatherback Sea Turtle
The leatherback sea turtle is unique among sea turtles for its large size, wide distribution (due to thermoregulatory systems and behavior), and lack of a hard, bony carapace. It ranges from tropical to subpolar latitudes, worldwide (Figure 5.2.8).

Figure 5.2.8. Range of the leatherback sea turtle



Leatherbacks are the largest living turtle, reaching lengths of six feet long, and weighing up to one ton. Leatherback sea turtles have a distinct black leathery skin covering their carapace with pinkish white skin on their plastron. The species was first listed under the Endangered Species Conservation Act (35 FR 8491, June 2, 1970) and has been listed as endangered under the ESA since 1973. In 2020, seven leatherback populations that met the discreteness and significance criteria of the DPS were identified (NMFS and USFWS 2020). The population found within the action is area is the Northwest Atlantic DPS (NW Atlantic DPS) (Figure 5.2.9). NMFS and USFWS concluded that the seven populations, which met the criteria for DPSs, all met the definition of an endangered species. NMFS and USFWS determined that the listing of DPSs was not warranted; leatherbacks continue to be listed as a species at the global level (85 FR 48332, August 10, 2020). Therefore, information is presented on the range-wide status of the species. We used information available in the five-year review (NMFS and USFWS 2013), the critical habitat designation (44 FR 17710, March 23, 1979), the status review (NMFS and USFWS 2020), relevant literature, and recent nesting data from the Florida FWRI to summarize the life history, population dynamics and status of the species, as follows.

Figure 5.2.9. Leatherback sea turtle DPSs and nesting beaches (NMFS and USFWS 2020)



Life History

Leatherbacks are a long-lived species. Preferred nesting grounds are in the tropics; though, nests span latitudes from 34°S in Western Cape, South Africa to 38 °N in Maryland (Eckert et al. 2012, Eckert et al. 2015). Females lay an average of five to seven clutches (range: 1-14 clutches) per season, with 20 to over 100 eggs per clutch (Eckert et al. 2012, Reina et al. 2002, Wallace et al. 2007). The average clutch frequency for the NW Atlantic population segment is 5.5 clutches per season (NMFS and USFWS 2020). In the western Atlantic, leatherbacks lay about 82 eggs per clutch (Sotherland et al. 2015). Remigration intervals are 2-4 years for most populations (range 1-11 years) (Eckert et al. 2015, NMFS and USFWS 2020); the remigration interval for the NW Atlantic population segment is approximately 3 years (NMFS and USFWS 2020). The number of leatherback hatchlings that make it out of the nest on to the beach (i.e., emergence success) is approximately 50% worldwide (Eckert et al. 2012).

Age at sexual maturity has been challenging to obtain given the species physiology and habitat use (Avens et al. 2019). Past estimates ranged from 5-29 years (Avens et al. 2009, Spotila et al. 1996). More recently, Avens et al. (2020) used refined skeletochronology to assess the age at sexual maturity for leatherback sea turtles in the Atlantic and the Pacific. In the Atlantic, the mean age at sexual maturity was 19 years (range 13-28) and the mean size at sexual maturity was 4.2 ft. (129.2 cm) CCL (range (3.7-5 ft. (112.8-153.8 cm)). In the Pacific, the mean age at sexual maturity was 17 years (range 12-28) and the mean size at sexual maturity was 4.2 ft. (129.3 cm) CCL (range 3.6- 5 ft. (110.7-152.3 cm)) (Avens et al. 2019).

Leatherbacks have a greater tolerance for colder waters compared to all other sea turtle species due to their thermoregulatory capabilities (Paladino et al. 1990, Shoop and Kenney 1992, Wallace and Jones 2008). Evidence from tag returns, satellite telemetry, and strandings in the western Atlantic suggests that adult leatherback sea turtles engage in routine migrations between temperate/boreal and tropical waters (Bond and James 2017, Dodge et al. 2015, Eckert et al. 2006, Fossette et al. 2014, James et al. 2005a, James et al. 2005b, James et al. 2005c, NMFS and USFWS 1992). Tagging studies collectively show a clear separation of leatherback movements between the North and South Atlantic Oceans (NMFS and USFWS 2020).

Leatherback sea turtles migrate long, transoceanic distances between their tropical nesting beaches and the highly productive temperate waters where they forage, primarily on jellyfish and tunicates. These gelatinous prey are relatively nutrient-poor, such that leatherbacks must consume large quantities to support their body weight. Leatherbacks weigh about 33% more on their foraging grounds than at nesting, indicating that they probably catabolize fat reserves to fuel migration and subsequent reproduction (James et al. 2005c, Wallace et al. 2006). Studies on the foraging ecology of leatherbacks in the North Atlantic show that leatherbacks off Massachusetts primarily consumed lion's mane, sea nettles, and ctenophores (Dodge et al. 2011). Juvenile and small sub-adult leatherbacks may spend more time in oligotrophic (relatively low plant nutrient usually accompanied by high dissolved oxygen) open ocean waters where prey is more difficult to find (Dodge et al. 2011). Sea turtles must meet an energy threshold before returning to nesting beaches. Therefore, their remigration intervals are dependent upon foraging success and duration (Hays 2000, Price et al. 2004).

Population Dynamics
The distribution is global, with nesting beaches in the Pacific, Atlantic, and Indian Oceans. Leatherbacks occur throughout marine waters, from nearshore habitats to oceanic environments (NMFS and USFWS 2020, Shoop and Kenney 1992). Movements are largely dependent upon reproductive and feeding cycles and the oceanographic features that concentrate prey, such as frontal systems, eddy features, current boundaries, and coastal retention areas (Benson et al. 2011).

Analyses of mtDNA from leatherback sea turtles indicates a low level of genetic diversity (Dutton et al. 1999). Further analysis of samples taken from individuals from rookeries in the Atlantic and Indian Oceans suggest that each of the rookeries represent demographically independent populations (NMFS and USFWS 2013). Using genetic data,, combined with nesting, tagging, and tracking data, researchers identified seven global regional management units (RMU) or subpopulations: Northwest Atlantic, Southeast Atlantic, Southwest Atlantic, Northwest Indian, Southwest Indian, East Pacific, and West Pacific (Wallace et al. 2010). The status review concluded that the RMUs identified by Wallace et al. (2010) are discrete populations and, then, evaluated whether any other populations exhibit this level of genetic discontinuity (NMFS and USFWS 2020).

To evaluate the RMUs and fine-scale structure in the Atlantic, Dutton et al. (2013) conducted a comprehensive genetic re-analysis of rookery stock structure. Samples from eight nesting sites in the Atlantic and one in the southwest Indian Ocean identified seven management units in the Atlantic and revealed fine scale genetic differentiation among neighboring populations. The mtDNA analysis failed to find significant differentiation between Florida and Costa Rica or between Trinidad and French Guiana/Suriname (Dutton et al. 2013). While Dutton et al. (2013) identified fine-scale genetic partitioning in the Atlantic Ocean, the differences did not rise to the level of marked separation or discreteness (NMFS and USFWS 2020). Other genetic analyses corroborate the conclusions of Dutton et al. (2013). These studies analyzed nesting sites in French Guiana (Molfetti et al. 2013), nesting and foraging areas in Brazil (Vargas et al. 2019), and nesting beaches in the Caribbean (Carreras et al. 2013). These studies all support three discrete populations in the Atlantic (NMFS and USFWS 2020). While these studies detected fine-scale genetic differentiation in the NW, SW, and SE Atlantic populations, the status review team determined that none indicated that the genetic differences were sufficient to be considered marked separation (NMFS and USFWS 2020).

Population growth rates for leatherback sea turtles vary by ocean basin. An assessment of leatherback populations through 2010 found a global decline overall (Wallace et al. 2013). Using datasets with abundance data series that are 10 years or greater, they estimated that leatherback populations have declined from 90,599 nests per year to 54,262 nests per year over three generations ending in 2010 (Wallace et al. 2013).

Several more recent assessments have been conducted. The Northwest Atlantic Leatherback Working Group was formed to compile nesting abundance data, analyze regional trends, and provide conservation recommendations. The most recent published IUCN Red List assessment for the NW Atlantic Ocean subpopulation estimated 20,000 mature individuals and approximately 23,000 nests per year (estimate to 2017) (Northwest Atlantic Leatherback

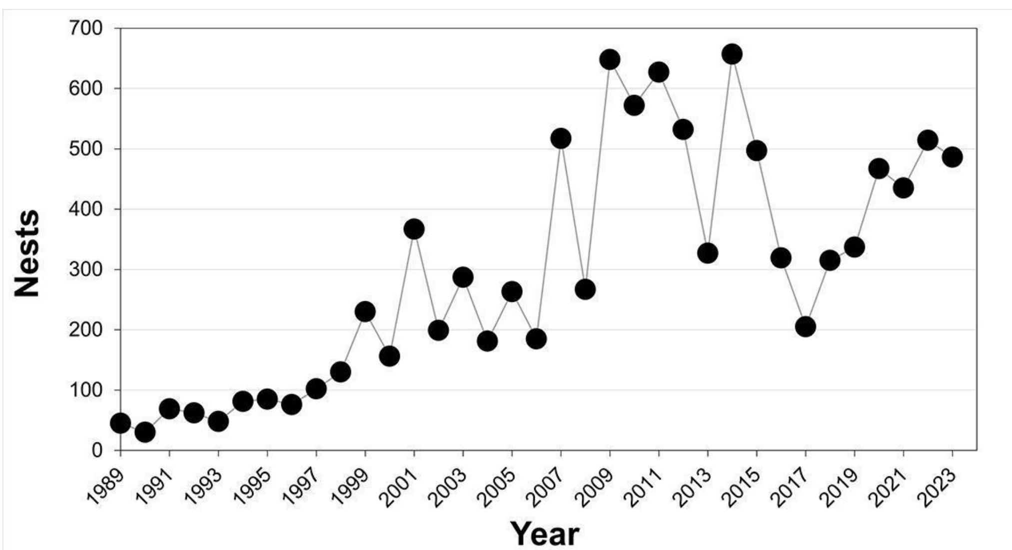
Working Group 2019). Annual nest counts show high inter-annual variability within and across nesting sites (Northwest Atlantic Leatherback Working Group 2018). Using data from 24 nesting sites in 10 nations within the NW Atlantic DPS, the leatherback status review estimated that the total index of nesting female abundance for the NW Atlantic DPS is 20,659 females (NMFS and USFWS 2020). This estimate only includes nesting data from recently and consistently monitored nesting beaches. An index (rather than a census) was developed given that the estimate is based on the number of nests on main nesting beaches with recent and consistent data and assumes a 3-year remigration interval. This index provides a minimum estimate of nesting female abundance (NMFS and USFWS 2020). This index of nesting female abundance is similar to other estimates. The TEWG estimated approximately 18,700 (range 10,000 to 31,000) adult females using nesting data from 2004 and 2005 (TEWG 2007). As described above, the IUCN Red List Assessment estimated 20,000 mature individuals (male and female). The estimate in the status review is higher than the estimate for the IUCN Red List assessment, likely due to a different remigration interval, which has been increasing in recent years (NMFS and USFWS 2020).

Previous assessments of leatherbacks concluded that the Northwest Atlantic population was stable or increasing (TEWG 2007, Tiwari et al. 2013b). However, based on more recent analyses, leatherback nesting in the Northwest Atlantic is showing an overall negative trend, with the most notable decrease occurring during the most recent period of 2008-2017 (Northwest Atlantic Leatherback Working Group 2018). The analyses for the IUCN Red List assessment indicate that the overall regional, abundance-weighted trends are negative (Northwest Atlantic Leatherback Working Group 2018, 2019). The dataset for trend analyses included 23 sites across 14 countries/territories. Three periods were used for the trend analysis: long-term (1990-2017), intermediate (1998-2017), and recent (2008-2017) trends. Overall, regional, abundance-weighted trends were negative across the periods and became more negative as the time-series became shorter. At the stock level, the Working Group evaluated the NW Atlantic – Guianas-Trinidad, Florida, Northern Caribbean, and the Western Caribbean. The NW Atlantic – Guianas-Trinidad stock is the largest stock and declined significantly across all periods, which was attributed to an exponential decline in abundance at Awala-Yalimapo, French Guiana as well as declines in Guyana, Suriname, Cayenne, and Matura. Declines in Awala-Yalimapo were attributed, in part, due to a beach erosion and a loss of nesting habitat (Northwest Atlantic Leatherback Working Group 2018). The Florida stock increased significantly over the long-term, but declined from 2008-2017. The Northern Caribbean and Western Caribbean stocks also declined over all three periods. The Working Group report also includes trends at the site-level, which varied depending on the site and time period, but were generally negative especially in the recent time period. The Working Group identified anthropogenic sources (fishery bycatch, vessel strikes), habitat loss, and changes in life history parameters as possible drivers of nesting abundance declines (Northwest Atlantic Leatherback Working Group 2018). Fisheries bycatch is a well-documented threat to leatherback turtles. The Working Group discussed entanglement in vertical line fisheries off New England and Canada as potentially important mortality sinks. They also noted that vessels strikes result in mortality annually in feeding habitats off New England. Off nesting beaches in Trinidad and the Guianas, net fisheries take leatherbacks in high numbers (~3,000/yr.) (Eckert 2013, Lum 2006, Northwest Atlantic Leatherback Working Group 2018).

Similarly, the leatherback status review concluded that the NW Atlantic population segment exhibits decreasing nest trends at nesting aggregations with the greatest indices of nesting female abundance. Significant declines have been observed at nesting beaches with the greatest historical or current nesting female abundance, most notably in Trinidad and Tobago, Suriname, and French Guiana. Though some nesting aggregations (see status review document for information on specific nesting aggregations) indicated increasing trends, most of the largest ones are declining. The declining trend is considered to be representative of the population segment (NMFS and USFWS 2020). The status review found that fisheries bycatch is the primary threat to the NW Atlantic population (NMFS and USFWS 2020).

Leatherback sea turtles nest in the southeastern United States. From 1989-2019, leatherback nests at core index beaches in Florida have varied from a minimum of 30 nests in 1990 to a maximum of 657 in 2014 (https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/). Leatherback nesting declined from 2014 to 2017 and then increased from 2018-2023. (https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/) (Figure 5.2.10). The status review found that the median trend for Florida from 2008-2017 was a decrease of 2.1% annually (NMFS and USFWS 2020).

Figure 5.2.10. Number of leatherback sea turtle nests on core index beaches in Florida from 1989-2023 (source: https://myfwc.com/media/uxmp43et/leatherbacknests.jpg)



For the SW Atlantic population, the status review estimates the total index of nesting female abundance at approximately 27 females (NMFS and USFWS 2020). This is similar to the IUCN Red List assessment that estimated 35 mature individuals (male and female) using nesting data since 2010. Nesting has increased since 2010 overall, though the 2014-2017 estimates were lower than the previous three years. The trend is increasing, though variable (NMFS and USFWS 2020). The SE Atlantic population has an index of nesting female abundance of 9,198 females and demonstrates a declining nest trend at the largest nesting aggregation (NMFS and

USFWS 2020). The SE Atlantic population exhibits a declining nest trend (NMFS and USFWS 2020).

Populations in the Pacific have shown dramatic declines at many nesting sites (Mazaris et al. 2017, Santidrián Tomillo et al. 2017, Santidrián Tomillo et al. 2007, Sarti Martínez et al. 2007, Tapilatu et al. 2013). For an IUCN Red List evaluation, datasets for nesting at all index beaches for the West Pacific population were compiled (Tiwari et al. 2013a). This assessment estimated the number of total mature individuals (males and females) at Jamursba-Medi and Wermon beaches to be 1,438 turtles (Tiwari et al. 2013a). Counts of leatherbacks at nesting beaches in the western Pacific indicate that the subpopulation declined at a rate of almost 6% per year from 1984 to 2011 (Tapilatu et al. 2013). More recently, the leatherback status review estimated the total index of nesting female abundance of the West Pacific population at 1,277 females, and the population exhibits low hatchling success (NMFS and USFWS 2020). The total index of nesting female abundance for the East Pacific population is 755 nesting females. It has exhibited a decreasing trend since monitoring began with a 97.4% decline since the 1980s or 1990s, depending on nesting beach (Wallace et al. 2013). The low productivity parameters, drastic reductions in nesting female abundance, and current declines in nesting place the population at risk (NMFS and USFWS 2020).

Population abundance in the Indian Ocean is difficult to assess due to lack of data and inconsistent reporting. Available data from southern Mozambique show that approximately 10 females nest per year from 1994 to 2004, and about 296 nests per year were counted in South Africa (NMFS and USFWS 2013). A 5-year status review in 2013 found that, in the southwest Indian Ocean, populations in South Africa are stable (NMFS and USFWS 2013). More recently, the 2020 status review estimated that the total index of nesting female abundance for the SW Indian DPS is 149 females and that the population is exhibiting a slight decreasing nest trend (NMFS and USFWS 2020). While data on nesting in the NE Indian Ocean population is limited, the DPS is estimated at 109 females. This population has exhibited a drastic population decline with extirpation of the largest nesting aggregation in Malaysia (NMFS and USFWS 2020).

Status

The leatherback sea turtle is an endangered species whose once large nesting populations have experienced steep declines in recent decades. While some populations show a stable or increasing nesting trend, there has been a global decline overall. For all populations, including the NW Atlantic, fisheries bycatch is the primary threat to the species (NMFS and USFWS 2020). Leatherback turtle nesting in the Northwest Atlantic showed an overall negative trend through 2017, with the most notable decrease occurring during 2008 to 2017 (Northwest Atlantic Leatherback Working Group 2018). Therefore, the leatherback status review in 2020 concluded that the NW Atlantic population exhibits an overall decreasing trend in annual nesting activity (NMFS and USFWS 2020). We note that the Florida index beaches have demonstrated an increasing trend from 2018-2023. Threats to leatherback sea turtles include loss of nesting habitat, fisheries bycatch, vessel strikes, harvest of eggs, and marine debris, among others (Northwest Atlantic Leatherback Working Group 2018). Because of the threats, once large nesting areas in the Indian and Pacific Oceans are now functionally extinct (Tiwari et al. 2013a) and there have been range-wide reductions in population abundance. The species' resilience to additional perturbation both within the NW Atlantic and worldwide is low.

Critical Habitat
Critical habitat has been designated for leatherback sea turtles in the waters adjacent to Sandy Point, St. Croix, U.S. Virgin Islands (44 FR 17710, March 23, 1979) and along the U.S. West Coast (77 FR 4170, January 26, 2012), both of which are outside the action area.

Recovery Goals
There are separate plans for the U.S. Caribbean, Gulf of Mexico, and Atlantic (NMFS and USFWS 1992) and the U.S. Pacific (NMFS and USFWS 1998) populations of leatherback sea turtles. Neither plan has been recently updated. As with other sea turtle species, the recovery plans for leatherbacks includes criteria for considering delisting. These criteria relate to increases in the populations, nesting trends, nesting beach and habitat protection, and implementation of priority actions. Criteria for delisting in the recovery plan for the U.S. Caribbean, Gulf of Mexico, and Atlantic are described here.

Delisting criteria

1. Adult female population increases for 25 years after publication of the recovery plan, as evidenced by a statistically significant trend in nest numbers at Culebra, Puerto Rico; St. Croix, U.S. Virgin Islands; and the east coast of Florida.
2. Nesting habitat encompassing at least 75% of nesting activity in the U.S. Virgin Islands, Puerto Rico, and Florida is in public ownership.
3. All priority-one tasks have been successfully implemented (see the recovery plan for a list of priority one tasks).

Major recovery actions in the U.S. Caribbean, Gulf of Mexico, and Atlantic include actions to:

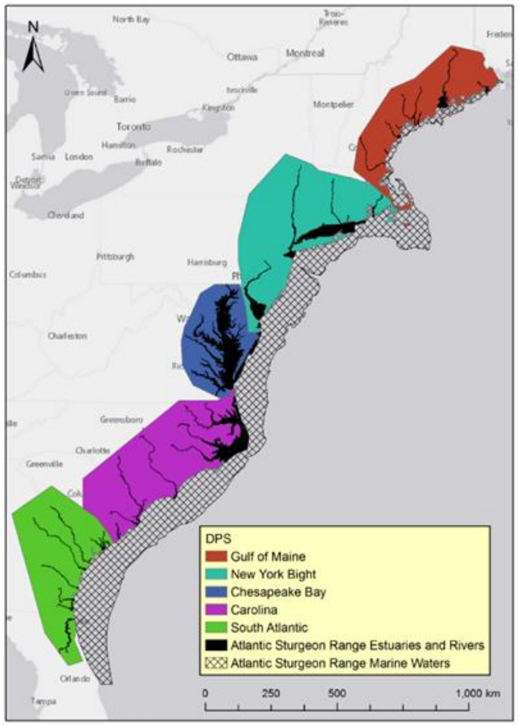
1. Protect and manage terrestrial and marine habitats.
2. Protect and manage the population.
3. Inform and educate the public.
4. Develop and implement international agreements.

The 2013 Five-Year Review (NMFS and USFWS 2013) concluded that the leatherback turtle should not be delisted or reclassified and notes that the 1991 and 1998 recovery plans are dated and do not address the major, emerging threat of climate change.

5.3 Atlantic Sturgeon

An estuarine-dependent anadromous species, Atlantic sturgeon occupy ocean and estuarine waters, including sounds, bays, and tidal-affected rivers from Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida (ASSRT 2007) (Figure 5.3.1). On February 6, 2012, NMFS listed five DPSs of Atlantic sturgeon under the ESA: Gulf of Maine (GOM), New York Bight (NYB), Chesapeake Bay (CB), Carolina, and South Atlantic (77 FR 5880 and 77 FR 5914). The Gulf of Maine DPS is listed as threatened, and the New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs are listed as endangered. Critical habitat has been designated for the five DPSs of Atlantic sturgeon (82 FR 39160, August 17, 2017) in rivers of the eastern United States. The conservation objective identified in the final rule is to increase the abundance of each DPS by facilitating increased successful reproduction and recruitment to the marine environment. The action area does not overlap with critical habitat designated for any of the five DPSs.

Figure 5.3.1.
Representative distribution of rivers of origin for ESA listed Atlantic sturgeon DPSs.



Information available from the 2007 Atlantic sturgeon status review (ASSRT 2007), 2017 ASMFC benchmark stock assessment (ASMFC 2017), final listing rules (77 FR 5880 and 77 FR 5914; February 6, 2012), material supporting the designation of Atlantic sturgeon critical habitat (NMFS 2017a), and Five-Year Reviews completed for the Gulf of Maine, New York Bight, and Chesapeake Bay DPSs (NMFS 2022a, b, c) and Carolina and South Atlantic DPSs (NMFS 2023a, 2023b) were used to summarize the life history, population dynamics, and status of the species.

Life History
Atlantic sturgeon are a late maturing, anadromous species (ASSRT 2007, Balazik et al. 2010, Hilton et al. 2016, Sulak and Randall 2002). Sexual maturity is reached between the ages of 5 to 34 years. Sturgeon originating from rivers in lower latitudes (e.g., South Carolina rivers) mature faster than those originating from rivers located in higher latitudes (e.g., Saint Lawrence River) (NMFS 2017a).

Atlantic sturgeon spawn in freshwater (ASSRT 2007, NMFS 2017b) at sites with flowing water and hard bottom substrate (Bain et al. 2000, Balazik et al. 2012b, Gilbert 1989, Greene et al.

2009, Hatin et al. 2002, Mohler 2003, Smith and Clugston 1997, Vladykov and Greeley 1963). Water depths of spawning sites are highly variable, but may be up to 88.5 ft. (27 m) (Bain et al. 2000, Crance 1987, Leland 1968, Scott and Crossman 1973). Based on tagging records, Atlantic sturgeon return to their natal rivers to spawn (ASSRT 2007), with spawning intervals ranging from one to five years in males (Caron et al. 2002, Collins et al. 2000b, Smith 1985) and two to five years in females (Stevenson and Secor 1999, Van Eenennaam et al. 1996, Vladykov and Greeley 1963). Some Atlantic sturgeon river populations may have up to two spawning seasons comprised of different spawning adults (Balazik and Musick 2015, Collins et al. 2000b), although the majority likely have just one, either in the spring or fall.[22] There is evidence of spring and fall spawning for the South Atlantic DPS (77 FR 5914, February 6, 2012, Collins et al. 2000b, NMFS and USFWS 1998b) (Collins et al. 2000b, NMFS and USFWS 1998), spring spawning for the Gulf of Maine and New York Bight DPSs (NMFS 2017a), and fall spawning for the Chesapeake and Carolina DPSs (Balazik et al. 2012a, Smith et al. 1984). Telemetry and empirical data suggest that there may be two potential spawning runs in the James River: a spring run from late March to early May and a fall run around September after an extended staging period in the lower river (Balazik et al. 2012a, Balazik and Musick 2015, Balazik et al. 2017a).

Following spawning, males move downriver to the lower estuary and remain there until outmigration in the fall (Bain 1997, Bain et al. 2000, Balazik et al. 2012a, Breece et al. 2013, Dovel and Berggren 1983a, Greene et al. 2009, Hatin et al. 2002, Ingram et al. 2019, Smith 1985, Smith et al. 1982). Females move downriver and may leave the estuary and travel to other coastal estuaries until outmigration to marine waters in the fall (Bain 1997, Bain et al. 2000, Balazik et al. 2012a, Breece et al. 2013, Dovel and Berggren 1983a, Greene et al. 2009, Hatin et al. 2002, NMFS 2017a, Smith 1985, Smith et al. 1982). Atlantic sturgeon deposit eggs on hard bottom substrate. They hatch into the yolk sac larval stage approximately 94 to 140 hours after deposition (Mohler 2003, Murawski and Pacheco 1977, Smith et al. 1980, Van Den Avyle 1984, Vladykov and Greeley 1963). Once the yolk sac is absorbed (eight to twelve days post-hatching), sturgeon are larvae. Shortly after, they become young of year and then juveniles. The juvenile stage can last months to years in the brackish waters of the natal estuary (ASSRT 2007, Calvo et al. 2010, Collins et al. 2000a, Dadswell 2006, Dovel and Berggren 1983b, Greene et al. 2009, Hatin et al. 2007, Holland and Yelverton 1973, Kynard and Horgan 2002, Mohler 2003, Schueller and Peterson 2010, Secor et al. 2000, Waldman et al. 1996). Upon reaching the sub-adult phase, individuals enter the marine environment, mixing with adults and sub-adults from other river systems (Bain 1997, Dovel and Berggren 1983a, Hatin et al. 2007, McCord et al. 2007) (NMFS 2017a). Once sub-adult Atlantic sturgeon have reached maturity/the adult stage, they will remain in marine or estuarine waters, only returning far upstream to the spawning areas when they are ready to spawn (ASSRT 2007, Bain 1997, Breece et al. 2016, Dunton et al. 2012, Dunton et al. 2015, Savoy and Pacileo 2003).

The life history of Atlantic sturgeon can be divided up into seven general categories as described in Table 5.3.1 below (adapted from ASSRT 2007).

Table 5.3.1. General descriptions of Atlantic sturgeon life history stages

[22] Although referred to as spring spawning and fall spawning, the actual time of Atlantic sturgeon spawning may not occur during the astronomical spring or fall season (Balazik and Musick 2015).

Age Class	Typical Size	General Duration	Representative Description
Egg	~2 mm – 3 mm diameter (Van Eenennaam et al. 1996)	Hatching occurs ~3-6 days after egg deposition and fertilization (ASSRT 2007)	Fertilized or unfertilized
Yolk-sac larvae (YSL)	~6mm – 14 mm (Bath et al. 1981)	8-12 days post hatch (ASSRT 2007)(p. 4))	Negative photo-taxic, nourished by yolk sac
Post yolk-sac larvae (PYSL)	~14mm – 37mm (Bath et al. 1981)	12-40 days post hatch	Free swimming; feeding; Silt/sand bottom, deep channel; fresh water
Young of Year (YOY)	0.3 grams <410mm TL	From 40 days to 1 year	Fish that are > 40 days and < one year; capable of capturing and consuming live food
Juveniles	>410mm and <760mm TL	1 year to time at which first coastal migration is made	Fish that are at least age 1 and are not sexually mature and do not make coastal migrations.
Subadults	>760 mm and <1500 mm TL	From first coastal migration to sexual maturity	Fish that are not sexually mature but make coastal migrations
Adults	>1500 mm TL	Post-maturation	Sexually mature fish

Population Dynamics

An index of population abundances for Atlantic sturgeon in oceanic waters off the Northeast coast of the U.S. during 2006-2011 was developed by Kocik et al. 2013. The report includes annual swept area abundance estimates of Atlantic sturgeon in nearshore areas derived from Northeast Area Monitoring and Assessment Program surveys conducted during 2007-2012.[23] For this Opinion, as we did in the prior 2021 Opinion, we are relying on the population estimates derived from the NEAMAP swept area biomass assuming a 50% catchability (i.e., net efficiency

[23] Since fall 2007, NEAMAP trawl surveys (spring and fall) have been conducted from Cape Cod, Massachusetts to Cape Hatteras, North Carolina in nearshore waters at depths up to 60 ft. (18.3 m). Each survey employs a spatially stratified random design with a total of 35 strata and 150 stations.

x availability) rate. We consider that the NEAMAP surveys sample an area utilized by Atlantic sturgeon but do not sample all the locations and times where Atlantic sturgeon are present. We also consider that the trawl net captures some, but likely not all, of the Atlantic sturgeon present in the sampling area. Therefore, we assume that net efficiency and the fraction of the population exposed to the NEAMAP surveys in combination result in a 50% catchability (NMFS 2013). The 50% catchability assumption reasonably accounts for the robust, yet not complete, sampling of the Atlantic sturgeon oceanic temporal and spatial ranges and the documented high rates of encounter with NEAMAP survey gear. As these estimates are derived directly from empirical data with fewer assumptions than have been required to model Atlantic sturgeon populations to date, we believe these estimates continue to serve as the best available information. Based on the above approach, the overall abundance of Atlantic sturgeon in U.S. Atlantic waters is estimated to be 67,776 fish (see table16 in Kocik et al. 2013). Based on genetic frequencies of occurrence in the sampled area, this overall population estimate was subsequently partitioned by DPS (Table 5.3.2). Given the proportion of adults to sub-adults in the NMFS NEFSC observer data at the time the population estimate was developed (approximate ratio of 1:3), we have also estimated the number of adults and sub-adults originating from each DPS. However, this cannot be considered an estimate of the total number of sub-adults because it only considers those sub-adults that are of a size that are present and vulnerable to capture in commercial trawl and gillnet gear in the marine environment.

It is important to note that the NEAMAP-based estimates do not include young-of-the-year (YOY) fish and juveniles in the rivers; however, those segments of the Atlantic sturgeon populations are at minimal risk from the proposed actions since they are rare to absent within the action area. The NEAMAP surveys are conducted in waters that include the preferred depth ranges of sub-adult and adult Atlantic sturgeon and take place during seasons that coincide with known Atlantic sturgeon coastal migration patterns in the ocean. However, the estimated number of sub-adults in marine waters is a minimum count because it only considers those sub-adults that are captured in a portion of the action area and are present in the marine environment, which is only a fraction of the total number of sub-adults. In regards to adult Atlantic sturgeon, the estimated population in marine waters is also a minimum count as the NEAMAP surveys sample only a portion of the action area, and therefore a portion of the Atlantic sturgeon's range.

Table 5.3.2. Calculated population estimates based upon the NEAMAP survey swept area model, assuming 50% efficiency

DPS	Estimated Ocean Population Abundance	Estimated Ocean Population of Adults	Estimated Ocean Population of Sub-adults (of size vulnerable to capture in fisheries)
GOM	7,455	1,864	5,591
NYB	34,566	8,642	25,925
CB	8,811	2,203	6,608
Carolina	1,356	339	1,017
SA	14,911	3,728	11,183

DPS	Estimated Ocean Population Abundance	Estimated Ocean Population of Adults	Estimated Ocean Population of Sub-adults (of size vulnerable to capture in fisheries)
Canada *(outside of the 5 ESA listed DPSs)*	*678*	*170*	*509*

Precise estimates of population growth rate (intrinsic rates) are unknown for the five listed DPSs of Atlantic sturgeon due to a lack of long-term abundance data. The Commission's 2017 stock assessment referenced a population viability assessment (PVA) that was done to determine population growth rates for the five DPSs based on a few long-term survey programs, but most results were statistically insignificant or utilized a model for which the available did not or poorly fit. In any event, the population growth rates reported from that PVA ranged from -1.8% to 4.9% (ASMFC 2017).

The genetic diversity of Atlantic sturgeon throughout its range has been well-documented (ASSRT 2007, Bowen and Avise 1990, O'Leary et al. 2014, Ong et al. 1996, Waldman et al. 1996, Waldman and Wirgin 1998, Kazyak et al. 2021, White et al. 2021). Overall, these studies have consistently found populations to be genetically diverse, and the majority can be readily differentiated. Relatively low rates of gene flow reported in population genetic studies (Fritts et al. 2016, Savoy et al. 2017, Wirgin et al. 2002) indicate that Atlantic sturgeon typically return to their natal river to spawn, despite extensive mixing in coastal waters.

The marine range of U.S. Atlantic sturgeon extends from Canada through Cape Canaveral, Florida. All five DPSs use the action area. Based on a recent genetic mixed stock analysis (Kazyak et al. 2021; the Vineyard Wind project area falls within the "MID Offshore" area described in that paper.), we expect Atlantic sturgeon throughout the action area originate from the five DPSs at the following frequencies: New York Bight (55.3%), Chesapeake (22.9%), South Atlantic (13.6%), Carolina (5.8%), Gulf of Maine (1.6%), and Gulf of Maine (1.6%) DPSs (Table 7.9.2). It is possible that a small fraction (0.7%) of Atlantic sturgeon in the action area may be Canadian origin (Kazyak et al. 2021); Canadian-origin Atlantic sturgeon are not listed under the ESA. This represents the best available information on the likely genetic makeup of individuals occurring throughout the action area.

Based on fishery-independent, fishery dependent, tracking, and tagging data, Atlantic sturgeon appear to primarily occur inshore of the 164 ft. (50 m) depth contour (Dunton et al. 2012, Dunton et al. 2010, Erickson et al. 2011, Laney et al. 2007, O'Leary et al. 2014, Stein et al. 2004a, b, Waldman et al. 2013, Wirgin et al. 2015a, Wirgin et al. 2015b). However, they are not restricted to these depths and excursions into deeper (e.g., 250 ft. (75 m)) continental shelf waters have been documented (Colette and Klein-MacPhee 2002, Collins and Smith 1997, Erickson et al. 2011, Stein et al. 2004b, Timoshkin 1968). Data from fishery-independent surveys and tagging and tracking studies also indicate that some Atlantic sturgeon may undertake seasonal movements along the coast (Dunton et al. 2010, Erickson et al. 2011, Hilton et al. 2016, Oliver et al. 2013, Post et al. 2014, Wippelhauser 2012). For instance, studies found that satellite-tagged adult sturgeon from the Hudson River concentrated in the southern part of the Mid-Atlantic

Bight, at depths greater than 66 ft. (20 m), during winter and spring; while, in the summer and fall, Atlantic sturgeon concentrations shifted to the northern portion of the Mid-Atlantic Bight at depths less than 66 ft. (20 m) (Erickson et al. 2011).

In the marine range, several marine aggregation areas occur adjacent to estuaries and/or coastal features formed by bay mouths and inlets along the U.S. eastern seaboard (i.e., waters off North Carolina; Chesapeake Bay; Delaware Bay; New York Bight; Massachusetts Bay; Long Island Sound; and Connecticut and Kennebec River Estuaries). Depths in these areas are generally no greater than 82 ft. (25 m) (Bain et al. 2000, Dunton et al. 2010, Erickson et al. 2011, Laney et al. 2007, O'Leary et al. 2014, Oliver et al. 2013, Savoy and Pacileo 2003, Stein et al. 2004b, Waldman et al. 2013, Wippelhauser 2012, Wippelhauser and Squiers 2015). Although additional studies are still needed to clarify why Atlantic sturgeon aggregate at these sites, there is some indication that they may serve as thermal refugia, wintering sites, or marine foraging areas (Dunton et al. 2010, Erickson et al. 2011, Stein et al. 2004b).

Status
Atlantic sturgeon were once present in 38 river systems and, of these, spawned in 35 (ASSRT 2007). They are currently present in 36 rivers and are probably present in additional rivers that provide sufficient forage base, depth, and access (ASSRT 2007). The benchmark stock assessment evaluated evidence for spawning tributaries and sub-populations of U.S. Atlantic sturgeon in 39 rivers. They confirmed (eggs, embryo, larvae, or YOY observed) spawning in ten rivers, considered spawning highly likely (adults expressing gametes, discrete genetic composition) in nine rivers, and suspected (adults observed in upper reaches of tributaries, historical accounts, presence of resident juveniles) spawning in six rivers. Spawning in the remaining rivers was unknown (ten) or suspected historical (four) (ASMFC 2017). The decline in abundance of Atlantic sturgeon has been attributed primarily to the large U.S. commercial fishery, which existed for the Atlantic sturgeon through the mid-1990s. Based on management recommendations in the ISFMP, adopted by the Commission in 1990, commercial harvest in Atlantic coastal states was severely restricted and ultimately eliminated from most coastal states (ASMFC 1998a). In 1998, the Commission placed a 20-40 year moratorium on all Atlantic sturgeon fisheries until the spawning stocked could be restored to a level where 20 subsequent year classes of adult females were protected (ASMFC 1998a, b). In 1999, NMFS closed the U.S. EEZ to Atlantic sturgeon retention, pursuant to the ACA (64 FR 9449; February 26, 1999). However, many state fisheries for sturgeon were closed prior to this.

As described in the listing rules and in the 2022 and 2023 5-year reviews, the most significant threats to Atlantic sturgeon are incidental catch, dams that block access to spawning habitat in southern rivers, poor water quality, dredging of spawning areas, water withdrawals from rivers, and vessel strikes. Climate change related impacts on water quality (e.g., temperature, salinity, dissolved oxygen, contaminants) also have the potential to affect Atlantic sturgeon populations using impacted river systems.

The ASMFC released a new benchmark stock assessment for Atlantic sturgeon in October 2017 (ASMFC 2017). Based on historic removals and estimated effective population size, the 2017 stock assessment concluded that all five Atlantic sturgeon DPSs are depleted relative to historical levels. However, the 2017 stock assessment does provide some evidence of population recovery at the coastwide scale, and mixed population recovery at the DPS scale (ASMFC 2017). The 2017 stock assessment also concluded that a variety of factors (i.e., bycatch, habitat loss, and ship strikes) continue to impede the recovery rate of Atlantic sturgeon (ASMFC 2017).

Despite the depleted status, the Commission's assessment did include signs that the coastwide index is above the 1998 value (95% probability). Total mortality from the tagging model was very low at the coastwide level. Small sample sizes made mortality estimates at the DPS level more difficult. By DPS, the assessment concluded that there was a 51% probability that the Gulf of Maine DPS abundance has increased since 1998 but a 74% probability that mortality for this DPS exceeds the mortality threshold used for the assessment. There is a relatively high (75%) probability that the New York Bight DPS abundance has increased since 1998, and a 31% probability that mortality exceeds the mortality threshold used for the assessment. There is also a relatively high (67%) probability that the Carolina DPS abundance has increased since 1998, and a relatively high probability (75%) that mortality for this DPS exceeds the mortality threshold used in the assessment. However, the index from the Chesapeake Bay DPS (highlighted red) only had a 36% chance of being above the 1998 value and a 30% probability that the mortality for this DPS exceeds the mortality threshold for the assessment. There was not enough information available to assess the abundance for the for the South Atlantic DPS relative to the 1998 moratorium, but the assessment did conclude that there was 40% probability that the mortality for this DPS exceeds the mortality threshold used in the assessment (ASMFC 2017). 5-Year reviews for each DPS, completed by NMFS in 2022 and 2023, summarize information that has become available since the listing. No changes to the classification for any DPS is recommended in the 5-year reviews (NMFS 2022 a, b, and c, NMFS 2023 a, b).

Recovery Goals for All DPSs

A Recovery Plan has not been completed for any DPS of Atlantic sturgeon. In 2018, NMFS published a Recovery Outline[24] to serve as an initial recovery-planning document. In this, the recovery vision is stated, "Subpopulations of all five Atlantic sturgeon DPSs must be present across the historical range. These subpopulations must be of sufficient size and genetic diversity to support successful reproduction and recovery from mortality events. The recruitment of juveniles to the sub-adult and adult life stages must also increase and that increased recruitment must be maintained over many years. Recovery of these DPSs will require conservation of the riverine and marine habitats used for spawning, development, foraging, and growth by abating threats to ensure a high probability of survival into the future." The Recovery Outline also includes steps that are expected to serve as an initial recovery action plan. These include protecting extant subpopulations and the species' habitat through reduction of threats; gathering information through research and monitoring on current distribution and abundance; and addressing vessel strikes in rivers, the effects of climate change and bycatch.

5.3.1 Gulf of Maine DPS

The Gulf of Maine DPS includes the following: all anadromous Atlantic sturgeons that are spawned in the watersheds from the Maine/Canadian border and, extending southward, all watersheds draining into the Gulf of Maine as far south as Chatham, MA. Within this range, Atlantic sturgeon historically spawned in the Androscoggin, Kennebec, Merrimack, Penobscot,

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[24] https://media.fisheries.noaa.gov/dam-migration/ats_recovery_outline.pdf; last accessed July 26, 2024.

and Sheepscot Rivers (ASSRT, 2007). Spawning occurs in the Kennebec River and may at least occasionally occur in the Androscoggin River below the Brunswick Dam (Wippelhauser et al. 2017). Despite the presence of suitable spawning habitat in a number of other rivers, there is no evidence of recent spawning in the remaining rivers. Atlantic sturgeons that are spawned elsewhere continue to use habitats within all of these rivers as part of their overall marine range (ASSRT, 2007). The movement of subadult and adult sturgeon between rivers, including to and from the Kennebec River and the Penobscot River, demonstrates that coastal and marine migrations are key elements of Atlantic sturgeon life history for the Gulf of Maine DPS (ASSRT, 2007; Fernandes, et al., 2010).

The current status of the Gulf of Maine DPS is affected by historical and modern fisheries dating as far back as the 1800s (Squiers et al., 1979; Stein et al., 2004; ASMFC 2007). Incidental capture of Atlantic sturgeon in state and Federal fisheries continues today. As explained above, we have estimates of the number of subadults and adults that are killed as a result of bycatch in fisheries authorized under Northeast FMPs. At this time, we are not able to quantify the impacts from other threats or estimate the number of individuals killed as a result of other anthropogenic threats. Habitat disturbance and direct mortality from anthropogenic sources are the primary concerns.

Some of the impacts from the threats that contributed to the decline of the Gulf of Maine DPS have been removed (e.g., directed fishing), or reduced as a result of improvements in water quality and removal of dams (e.g., the Edwards Dam on the Kennebec River in 1999, the Veazie Dam on the Penobscot River). There are strict regulations on the use of fishing gear in Maine state waters that incidentally catch sturgeon. In addition, there have been reductions in fishing effort in state and federal waters, which most likely would result in a reduction in bycatch mortality of Atlantic sturgeon. A significant amount of fishing in the Gulf of Maine is conducted using trawl gear, which is known to have a much lower mortality rate for Atlantic sturgeon caught in the gear compared to sink gillnet gear (ASMFC, 2007). Atlantic sturgeon from the GOM DPS are not commonly taken as bycatch in areas south of Chatham, MA, with only 8 percent (e.g., 7 of the 84 fish) of interactions observed in the Mid Atlantic/Carolina region being assigned to the Gulf of Maine DPS (Wirgin and King, 2011). Tagging results also indicate that Gulf of Maine DPS fish tend to remain within the waters of the Gulf of Maine and only occasionally venture to points south. However, data on Atlantic sturgeon incidentally caught in trawls and intertidal fish weirs fished in the Minas Basin area of the Bay of Fundy (Canada) indicate that approximately 35 percent originated from the Gulf of Maine DPS (Wirgin *et al.*2012).

As noted previously, studies have shown that in order to rebuild, Atlantic sturgeon can only sustain low levels of bycatch and other anthropogenic mortality (Boreman, 1997; ASMFC, 2007; Kahnle *et al.*, 2007; Brown and Murphy, 2010). NMFS has determined that the Gulf of Maine DPS is at risk of becoming endangered in the foreseeable future throughout all of its range (i.e., is a threatened species) based on the following: (1) significant declines in population sizes and the protracted period during which sturgeon populations have been depressed; (2) the limited amount of current spawning; and, (3) the impacts and threats that have and will continue to affect recovery.

In 2018, we announced the initiation of a 5-year review for the Gulf of Maine DPS. We reviewed and considered new information for the Gulf of Maine DPS that has become available since this DPS was listed as threatened in February 2012. We completed the 5-year review for the Gulf of Maine DPS in February 2022 (NMFS 2022a); the review includes a summary of additional information available since the listing determination, including information on life history and threats. Based on the best scientific and commercial data available at the time of the review, we concluded that no change to the listing status is warranted.

5.3.2 New York Bight DPS

The New York Bight DPS includes the following: all anadromous Atlantic sturgeon spawned in the watersheds that drain into coastal waters from Chatham, MA to the Delaware-Maryland border on Fenwick Island. Within this range, Atlantic sturgeon historically spawned in the Connecticut, Delaware, Hudson, and Taunton Rivers (Murawski and Pacheco, 1977; Secor, 2002; ASSRT, 2007). Spawning still occurs in the Delaware and Hudson Rivers. There is no recent evidence (within the last 15 years) of spawning in the Taunton River (ASSRT, 2007). Atlantic sturgeon that are spawned elsewhere continue to use habitats within the Connecticut and Taunton Rivers as part of their overall marine range (ASSRT, 2007; Savoy, 2007; Wirgin and King, 2011).

In 2014, several presumed age-0 Atlantic sturgeon were captured in the Connecticut River; the available information indicates that successful spawning took place in 2013 by a small number of adults. Genetic analysis of the juveniles indicates that the adults were likely migrants from the South Atlantic DPS (Savoy et al. 2017). As noted by the authors, this conclusion is counter to prevailing information regarding straying of adult Atlantic sturgeon. As these captures represent the only contemporary records of possible natal Atlantic sturgeon in the Connecticut River and the genetic analysis is unexpected, more information is needed to establish the frequency of spawning in the Connecticut River and whether there is a unique Connecticut River population of Atlantic sturgeon. At this time, we are not able to conclude whether the juvenile sturgeon detected are indicative of sustained spawning in the river or whether they were the result of a single spawning event due to unique straying of the adults from the South Atlantic DPS's spawning rivers (see additional explanation in NMFS 2022b).

There are no abundance estimates for the entire New York Bight DPS or for the entirety of the (i.e., all age classes) Hudson River or Delaware River populations. The abundance of the Hudson River Atlantic sturgeon riverine population prior to the onset of expanded exploitation in the 1800s is unknown but has been conservatively estimated at 10,000 adult females (Secor, 2002). Current abundance is likely at least one order of magnitude smaller than historical levels (Secor, 2002; ASSRT, 2007; Kahnle *et al.*, 2007). As described above, an estimate of the mean annual number of mature adults (863 total; 596 males and 267 females) was calculated for the Hudson River riverine population based on fishery-dependent data collected from 1985-1995 (Kahnle *et al.*, 2007). Kahnle *et al.* (1998; 2007) also showed that the level of fishing mortality from the Hudson River Atlantic sturgeon fishery during the period of 1985-1995 exceeded the estimated sustainable level of fishing mortality for the riverine population and may have led to reduced recruitment. A decline in the abundance of young Atlantic sturgeon appeared to occur in the mid to late 1970s followed by a secondary drop in the late 1980s (Kahnle *et al.*, 1998; Sweka *et al.*, 2007; ASMFC, 2010). At the time of listing, catch-per-unit-effort (CPUE) data suggested that recruitment remained depressed relative to catches of juvenile Atlantic sturgeon in the estuary during the mid-late 1980s (Sweka *et al.*, 2007; ASMFC, 2010). In examining the CPUE data from 1985-2007, there are significant fluctuations during this time. There appears to be a decline in the number of juveniles between the late 1980s and early 1990s while the CPUE is generally higher in the 2000s as compared to the 1990s. Recent analyses suggest that the abundance of juvenile Atlantic sturgeon belonging to the Hudson River spawning population has increased, with double the average catch rate for the period from 2012-2019 compared to the previous eight years, from 2004-2011 (Pendleton and Adams 2021).

There is limited new information on the spawning population abundance in the Hudson River since the time of listing; Kazyak et al. (2020) used side scan sonar technology in conjunction with detections of previously tagged Atlantic sturgeon to estimate a Hudson River spawning run size of 466 sturgeon (95% CRI = 310-745) in 2014. Another method for assessing the number of spawning adults is through determinations of effective population size (the number of individuals that effectively participates in producing the next generation, see NMFS 2022b for more information). The estimates of effective population size for the Hudson River spawning population from separate studies and based on different age classes are relatively similar to each other: 198 (95% CI=171.7-230.7) based on sampling of subadults captured off of Long Island across multiple years, 156 (95% CI=138.3-176.1) based on sampling of natal juveniles in multiple years (O'Leary et al. 2014; Waldman et al. 2019), and 144.2 (95% CI=82.9-286.6) based on samples from a combination of juveniles and adults (ASMFC 2017).

As described in the Status Review and listing rule, in addition to capture in fisheries operating in Federal waters, bycatch and mortality also occur in state fisheries; however, the primary fishery (shad) that impacted juvenile sturgeon in the Hudson River, has now been closed and there is no indication that it will reopen soon. In the Hudson River, sources of potential mortality include vessel strikes and entrainment in dredges. Individuals are also exposed to effects of bridge construction (including the replacement of the Tappan Zee Bridge). Impingement at water intakes, including the Danskammer, Roseton, and Indian Point power plants has been documented in the past. Recent information from surveys of juveniles (see above) indicates that the number of young Atlantic sturgeon in the Hudson River is increasing compared to recent years, but is still low compared to the 1970s. There is currently not enough information regarding any life stage to establish a trend for the entire Hudson River population.

There is no total abundance estimate for the Delaware River population of Atlantic sturgeon. Harvest records from the 1800s indicate that this was historically a large population with an estimated 180,000 adult females prior to 1890 (Secor and Waldman, 1999; Secor, 2002). Sampling in 2009 to target young-of- the year (YOY) Atlantic sturgeon in the Delaware River (i.e., natal sturgeon) resulted in the capture of 34 YOY, ranging in size from 178 to 349 mm TL (Fisher, 2009) and the collection of 32 YOY Atlantic sturgeon in a separate study (Brundage and O'Herron in Calvo *et al.*, 2010). Genetics information collected from 33 of the 2009-year class YOY indicates that at least three females successfully contributed to the 2009-year class (Fisher, 2011). Therefore, while the capture of YOY in 2009 provides evidence that successful spawning is still occurring in the Delaware River, the relatively low numbers suggest the existing riverine population is limited in size. The Delaware Division of Fish and Wildlife (DFW) has conducted juvenile abundance surveys in the Delaware River in most years since 2010. The estimated abundance in 2014 was 3,656 (95% CI = 1,935–33,041) age 0-1 juvenile Atlantic (Hale et al. 2016). Estimates for the Delaware River spawning population by the same authors and using the same methods as described above for the Hudson River were: 108.7 (95% CI=74.7-186.1) and 40 (95% CI=34.7-46.2) for samples from subadults and natal juveniles, respectively (O'Leary et al. 2014; Waldman et al. 2019), and 56.7 (95% CI=42.5-77.0) based on samples from a combination of juveniles and adults (ASMFC 2017).

Some of the impacts from the threats that contributed to the decline of the New York Bight DPS have been removed (e.g., directed fishing) or reduced as a result of improvements in water quality since passage of the Clean Water Act (CWA). In addition, there have been reductions in fishing effort in state and federal waters, which may result in a reduction in bycatch mortality of Atlantic sturgeon. Nevertheless, areas with persistent, degraded water quality, habitat impacts from dredging, continued bycatch in state and federally managed fisheries, and vessel strikes remain significant threats to the New York Bight DPS.

In the marine range, New York Bight DPS Atlantic sturgeon are incidentally captured in federal and state managed fisheries, reducing survivorship of subadult and adult Atlantic sturgeon (Stein *et al.*, 2004; ASMFC 2007). As explained above, currently available estimates indicate that at least 4% of adults may be killed as a result of bycatch in fisheries authorized under Northeast FMPs. Based on mixed stock analysis results presented by Wirgin and King (2011), over 40 percent of the Atlantic sturgeon bycatch interactions in the Mid Atlantic Bight region were sturgeon from the New York Bight DPS. Individual-based assignment and mixed stock analysis of samples collected from sturgeon captured in Canadian fisheries in the Bay of Fundy indicated that approximately 1-2% were from the New York Bight DPS. At this time, we are not able to quantify the impacts from other threats or estimate the number of individuals killed as a result of other anthropogenic threats.

Riverine habitat may be impacted by dredging and other in-water activities, disturbing spawning habitat, and altering the benthic forage base. Both the Hudson and Delaware rivers have navigation channels that are maintained by dredging. Dredging is also used to maintain channels in the nearshore marine environment. Dredging outside of Federal channels and in-water construction occurs throughout the New York Bight region. While some dredging projects operate with observers present to document fish mortalities many do not. We have reports of one Atlantic sturgeon entrained during hopper dredging operations in Ambrose Channel, New Jersey, and a number of Atlantic sturgeon have been killed during Delaware River channel maintenance and deepening activities.

In the Hudson and Delaware Rivers, dams do not block access to historical habitat. The Holyoke Dam on the Connecticut River blocks further upstream passage; however, the extent that Atlantic sturgeon would historically have used habitat upstream of Holyoke is unknown. Connectivity may be disrupted by the presence of dams on several smaller rivers in the New York Bight region. Because no Atlantic sturgeon occur upstream of any hydroelectric projects in the New York Bight region, passage over hydroelectric dams or through hydroelectric turbines is not a source of injury or mortality in this area.

New York Bight DPS Atlantic sturgeon may also be affected by degraded water quality. In general, water quality has improved in the Hudson and Delaware over the past decades (Lichter *et al.* 2006; EPA, 2008). Both the Hudson and Delaware rivers, as well as other rivers in the New York Bight region, were heavily polluted in the past from industrial and sanitary sewer discharges. While water quality has improved and most discharges are limited through regulations, many pollutants persist in the benthic environment. This can be particularly problematic if pollutants are present on spawning and nursery grounds as developing eggs and larvae are particularly susceptible to exposure to contaminants.

Vessel strikes occur in the Delaware and Hudson rivers. A summary of recently available information is included in NMFS 2022 b. NMFS has only minimum counts of the number of Atlantic sturgeon that are struck and killed by vessels because only sturgeon that are found dead with evidence of a vessel strike are counted. New research, including a study that intentionally placed Atlantic sturgeon carcasses along the Delaware River in areas used by the public, suggests that most Atlantic sturgeon carcasses are not found and, when found, many are not reported to NMFS or to our sturgeon salvage coinvestigators (Balazik et al. 2012b, Balazik, pers. comm. in ASMFC 2017; Fox et al. 2020). Based on the reporting rates in their study, Fox et al. estimated that a total of 199 and 213 carcasses were present along the Delaware Estuary shoreline in 2018 and 2019, respectively. Delaware State University (DSU) collaborated with the Delaware Division of Fish and Wildlife (DDFW) in an effort to document vessel strikes in 2005. Approximately 200 reported carcasses with over half being attributed to vessel strikes based on a gross examination of wounds have been documented through 2019 (DiJohnson 2019). One hundred thirty-eight (138) sturgeon carcasses were observed on the Hudson River and reported to the NYSDEC between 2007 and 2015. Of these, 69 are suspected of having been killed by vessel strike. Genetic analysis has not been completed on any of these individuals to date, given that the majority of Atlantic sturgeon in the Hudson River belong to the New York Bight DPS; we assume that the majority of the dead sturgeon reported to NYSDEC belonged to the New York Bight DPS. Given the time of year in which the fish were observed (predominantly May through July), it is likely that many of the adults were migrating through the river to the spawning grounds.

Studies have shown that to rebuild, Atlantic sturgeon can only sustain low levels of anthropogenic mortality (Boreman, 1997; ASMFC, 2007; Kahnle *et al.*, 2007; Brown and Murphy, 2010). There are no empirical abundance estimates of the number of Atlantic sturgeon in the New York Bight DPS. We determined that the New York Bight DPS is currently at risk of extinction due to: (1) precipitous declines in population sizes and the protracted period in which sturgeon populations have been depressed; (2) the limited amount of current spawning; and (3) the impacts and threats that have and will continue to affect population recovery.

In 2018, we announced the initiation of a 5-year review for the New York Bight DPS. We reviewed and considered new information for the New York Bight DPS that has become available since this DPS was listed as endangered in February 2012. We completed the 5-year review for the DPS in February 2022 (NMFS 2022b); the review includes a summary of additional information available since the listing determination, including information on life history and threats. Based on the best scientific and commercial data available at the time of the review, we concluded that no change to the listing status is warranted.

5.3.3 Chesapeake Bay DPS

The Chesapeake Bay (CB) DPS includes the following: all anadromous Atlantic sturgeon that spawn or are spawned in the watersheds that drain into the Chesapeake Bay and into coastal waters from the Delaware-Maryland border on Fenwick Island to Cape Henry, Virginia. The marine range of Atlantic sturgeon from the CB DPS extends from Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida. The riverine range of the CB DPS and the adjacent portion of the marine range are shown in Figure 5.3.1. Within this range, Atlantic sturgeon historically spawned in the Susquehanna, Potomac, James, York, Rappahannock, and Nottoway Rivers (ASSRT 2007). Based on the review by Oakley (2003), 100% of Atlantic sturgeon habitat is currently accessible in these rivers since most of the barriers to passage (i.e., dams) are located upriver of where spawning is expected to have historically occurred (ASSRT 2007).

At the time of listing, the James River was the only known spawning river for the Chesapeake Bay DPS (ASSRT, 2007; Hager, 2011; Balazik et al., 2012). Since the listing, evidence has been provided of both spring and fall spawning populations for the James River, as well as fall spawning in the Pamunkey River, a tributary of the York River, and fall spawning in Marshyhope Creek, a tributary of the Nanticoke River (Hager et al., 2014; Kahn et al., 2014; Balazik and Musick, 2015; Richardson and Secor, 2016). Detections of acoustically-tagged adult Atlantic sturgeon along with historical evidence suggests that Atlantic sturgeon belonging to the Chesapeake Bay DPS may be spawning in the Mattaponi and Rappahannock rivers as well (Hilton et al. 2016; ASMFC 2017a; Kahn et al. 2019). However, information for these populations is limited and the research is ongoing.

Several threats play a role in shaping the current status of CB DPS Atlantic sturgeon. Historical records provide evidence of the large-scale commercial exploitation of Atlantic sturgeon from the James River and Chesapeake Bay in the 19th century (Hildebrand and Schroeder 1928; Vladykov and Greeley 1963; ASMFC 1998b; Secor 2002; Bushnoe *et al.* 2005; ASSRT 2007) as well as subsistence fishing and attempts at commercial fisheries as early as the 17th century (Secor 2002; Bushnoe *et al.* 2005; ASSRT 2007; Balazik *et al.* 2010). Habitat disturbance caused by in-river work, such as dredging for navigational purposes, is thought to have reduced available spawning habitat in the James River (Holton and Walsh 1995; Bushnoe *et al.* 2005; ASSRT 2007). At this time, we do not have information to quantify this loss of spawning habitat.

Decreased water quality also threatens Atlantic sturgeon of the CB DPS, especially since the Chesapeake Bay system is vulnerable to the effects of nutrient enrichment due to a relatively low tidal exchange and flushing rate, large surface-to-volume ratio, and strong stratification during the spring and summer months (Pyzik *et al.* 2004; ASMFC 1998a; ASSRT 2007; EPA 2008). These conditions contribute to reductions in dissolved oxygen levels throughout the Bay. The availability of nursery habitat, in particular, may be limited given the recurrent hypoxia (low dissolved oxygen) conditions within the Bay (Niklitschek and Secor 2005, 2010). Heavy industrial development during the 20th century in rivers inhabited by sturgeon impaired water quality and impeded these species' recovery.

Although there have been improvements in the some areas of the Bay's health, the ecosystem remains in poor condition. At this time, we do not have sufficient information to quantify the extent that degraded water quality effects habitat or individuals in the Chesapeake Bay watershed.

More than 100 Atlantic sturgeon carcasses have been salvaged in the James River since 2007 and additional carcasses were reported but could not be salvaged (Greenlee et al. 2019). Many of the salvaged carcasses had evidence of a fatal vessel strike. In addition, vessel struck Atlantic sturgeon have been found in other parts of the Chesapeake Bay DPS's range including in the York and Nanticoke river estuaries, within Chesapeake Bay, and near the mouth of the Bay since the DPS was listed as endangered (NMFS Sturgeon Salvage Permit Reporting; Secor et al. 2021).

In the marine and coastal range of the CB DPS from Canada to Florida, fisheries bycatch in federally and state-managed fisheries poses a threat to the DPS, reducing survivorship of subadults and adults and potentially causing an overall reduction in the spawning population (Stein *et al.* 2004b; ASMFC TC 2007; ASSRT 2007).

Areas with persistent, degraded water quality, habitat impacts from dredging, continued bycatch in U.S. state and federally managed fisheries, Canadian fisheries, and vessel strikes remain significant threats to the CB DPS of Atlantic sturgeon. Of the 35% of Atlantic sturgeon incidentally caught in the Bay of Fundy, about 1% were CB DPS fish (Wirgin *et al.* 2012). Studies have shown that Atlantic sturgeon can only sustain low levels of bycatch mortality (Boreman 1997; ASMFC TC 2007; Kahnle *et al.* 2007). The CB DPS is currently at risk of extinction given (1) precipitous declines in population sizes and the protracted period in which sturgeon populations have been depressed; (2) the limited amount of current spawning; and, (3) the impacts and threats that have and will continue to affect the potential for population recovery.

In 2018, we announced the initiation of a 5-year review for the Chesapeake Bay DPS. We reviewed and considered new information for the Chesapeake Bay DPS that has become available since this DPS was listed as endangered in February 2012. We completed the 5-year review for the Chesapeake Bay DPS in February 2022 (NMFS 2022c); the review includes a summary of additional information available since the listing determination, including information on life history and threats. Based on the best scientific and commercial data available at the time of the review, we concluded that no change to the listing status is warranted.

5.3.4 Carolina DPS

The Carolina DPS includes all Atlantic sturgeon that spawn or are spawned in the watersheds (including all rivers and tributaries) from Albemarle Sound southward along the southern Virginia, North Carolina, and South Carolina coastal areas to Charleston Harbor. The marine range of Atlantic sturgeon from the Carolina DPS extends from the Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida.

Rivers in the Carolina DPS considered to be spawning rivers include the Neuse, Roanoke, Tar-Pamlico, Cape Fear, and Northeast Cape Fear rivers, and the Santee-Cooper and Pee Dee river

(Waccamaw and Pee Dee rivers) systems. Historically, both the Sampit and Ashley Rivers were documented to have spawning populations at one time. However, the spawning population in the Sampit River is believed to be extirpated and the current status of the spawning population in the Ashley River is unknown. We have no information, current or historical, of Atlantic sturgeon using the Chowan and New Rivers in North Carolina. Recent telemetry work by Post et al. (2014) indicates that Atlantic sturgeon do not use the Sampit, Ashley, Ashepoo, and Broad-Coosawhatchie Rivers in South Carolina. These rivers are short, coastal plains rivers that most likely do not contain suitable habitat for Atlantic sturgeon. Fish from the Carolina DPS likely use other river systems than those listed here for their specific life functions.

Historical landings data indicate that between 7,000 and 10,500 adult female Atlantic sturgeon were present in North Carolina prior to 1890 (Armstrong and Hightower 2002, Secor 2002). Secor (2002) estimates that 8,000 adult females were present in South Carolina during that same period. Reductions from the commercial fishery and ongoing threats have drastically reduced the numbers of Atlantic sturgeon within the Carolina DPS. Currently, the Atlantic sturgeon spawning population in at least one river system within the Carolina DPS has been extirpated, with a potential extirpation in an additional system. The ASSRT estimated the remaining river populations within the DPS to have fewer than 300 spawning adults; this is thought to be a small fraction of historic population sizes (ASSRT 2007).

The Carolina DPS was listed as endangered under the ESA as a result of a combination of habitat curtailment and modification, overutilization (i.e., being taken as bycatch) in commercial fisheries, and the inadequacy of regulatory mechanisms in ameliorating these impacts and threats.

The modification and curtailment of Atlantic sturgeon habitat resulting from dams, dredging, and degraded water quality is contributing to the status of the Carolina DPS. Dams have curtailed Atlantic sturgeon spawning and juvenile developmental habitat by blocking over 60 percent of the historical sturgeon habitat upstream of the dams in the Cape Fear and Santee-Cooper River systems. Water quality (velocity, temperature, and dissolved oxygen (DO)) downstream of these dams, as well as on the Roanoke River, has been reduced, which modifies and curtails the extent of spawning and nursery habitat for the Carolina DPS. Dredging in spawning and nursery grounds modifies the quality of the habitat and is further curtailing the extent of available habitat in the Cape Fear and Cooper Rivers, where Atlantic sturgeon habitat has already been modified and curtailed by the presence of dams. Reductions in water quality from terrestrial activities have modified habitat utilized by the Carolina DPS. In the Pamlico and Neuse systems, nutrient-loading and seasonal anoxia are occurring, associated in part with concentrated animal feeding operations (CAFOs). Heavy industrial development and CAFOs have degraded water quality in the Cape Fear River. Water quality in the Waccamaw and Pee Dee rivers have been affected by industrialization and riverine sediment samples contain high levels of various toxins, including dioxins. Additional stressors arising from water allocation and climate change threaten to exacerbate water quality problems that are already present throughout the range of the Carolina DPS. The removal of large amounts of water from the system will alter flows, temperature, and DO. Existing water allocation issues will likely be compounded by population growth and potentially, by climate change. Climate change is also predicted to elevate water temperatures and exacerbate nutrient-loading, pollution inputs, and lower DO, all of which are current stressors to the Carolina DPS.

Overutilization of Atlantic sturgeon from directed fishing caused initial severe declines in Atlantic sturgeon populations in the Southeast, from which they have never rebounded. Further, continued overutilization of Atlantic sturgeon as bycatch in commercial fisheries is an ongoing impact to the Carolina DPS. Little data exists on bycatch in the Southeast and high levels of bycatch underreporting are suspected. Stress or injury to Atlantic sturgeon taken as bycatch but released alive may result in increased susceptibility to other threats, such as poor water quality (e.g., exposure to toxins and low DO). This may result in reduced ability to perform major life functions, such as foraging and spawning, or even post-capture mortality.

As a wide-ranging anadromous species, Carolina DPS Atlantic sturgeon are subject to numerous Federal (U.S. and Canadian), state and provincial, and inter-jurisdictional laws, regulations, and agency activities. While these mechanisms have addressed impacts to Atlantic sturgeon through directed fisheries, there are currently no mechanisms in place to address the significant risk posed to Atlantic sturgeon from commercial bycatch. Though statutory and regulatory mechanisms exist that authorize reducing the impact of dams on riverine and anadromous species, such as Atlantic sturgeon, and their habitat, these mechanisms have proven inadequate for preventing dams from blocking access to habitat upstream and degrading habitat downstream. Further, water quality continues to be a problem in the Carolina DPS, even with existing controls on some pollution sources. Current regulatory regimes are not necessarily effective in controlling water allocation issues (e.g., no restrictions on interbasin water transfers in South Carolina, the lack of ability to regulate non-point source pollution, etc.).

In the 2023 5-year review for the Carolina DPS, NMFS SERO reviewed and considered new information for the DPS that has become available since this DPS was listed as endangered in February 2012. In the review, NMFS concluded that the Carolina DPS's demographic risk is "High" because of its productivity (i.e., relatively few adults compared to historical levels and irregular spawning success), abundance (i.e., riverine populations vary significantly and abundance is generally low in the DPS, overall), and spatial distribution (i.e., riverine populations and connectivity vary, creating inconsistent population coverage across the DPS and potentially limited ability to repopulate extirpated river populations). However, NMFS also concluded that the Carolina DPS' potential to recover is also "High" because man-made threats that have a major impact on the species' ability to persist have been identified (e.g., bycatch in federally-managed fisheries, dams blocking access to spawning habitat, dredging, vessel strikes), the DPS' response to those threats are well understood, management or protective actions to address major threats are primarily under U.S. jurisdiction or authority, and management or protective actions are technically feasible even if they require further testing (e.g., gear modifications to minimize dredge or fishing gear interactions).The review includes a summary of additional information available since the listing determination, including information on life history and threats. Based on the best scientific and commercial data available at the time of the review, the review concluded that no change to the listing status is warranted. (NMFS 2023a).

5.3.5 *South Atlantic DPS*

The South Atlantic DPS includes all Atlantic sturgeon that spawn or are spawned in the watersheds (including all rivers and tributaries) of the Ashepoo, Combahee, and Edisto Rivers (ACE) Basin southward along the South Carolina, Georgia, and Florida coastal areas to the St. Johns River, Florida.

Rivers known to have current spawning populations within the range of the South Atlantic DPS include the Combahee, Edisto, Savannah, Ogeechee, Altamaha, St. Marys, and Satilla Rivers. Recent telemetry work by Post et al. (2014) indicates that Atlantic sturgeon do not use the Sampit, Ashley, Ashepoo, and Broad-Coosawhatchie Rivers in South Carolina. These rivers are short, coastal plains rivers that most likely do not contain suitable habitat for Atlantic sturgeon. Post et al. (2014) also found Atlantic sturgeon only use the portion of the Waccamaw River downstream of Bull Creek. Due to manmade structures and alterations, spawning areas in the St. Johns River are not accessible and therefore do not support a reproducing population.

Secor (2002) estimates that 8,000 adult females were present in South Carolina prior to 1890. Prior to the collapse of the fishery in the late 1800s, the sturgeon fishery was the third largest fishery in Georgia. Secor (2002) estimated from U.S. Fish Commission landing reports that approximately 11,000 spawning females were likely present in the state prior to 1890. Reductions from the commercial fishery and ongoing threats have drastically reduced the numbers of Atlantic sturgeon within the South Atlantic DPS. Currently, the Atlantic sturgeon spawning population in at least one river system within the South Atlantic DPS has been extirpated. The Altamaha River population of Atlantic sturgeon, with an estimated 343 adults spawning annually, is believed to be the largest population in the Southeast, yet is estimated to be only 6 percent of its historical population size. The ASSRT estimated the abundances of the remaining river populations within the DPS, each estimated to have fewer than 300 spawning adults, to be less than 1 percent of what they were historically (ASSRT 2007).

The South Atlantic DPS was listed as endangered under the ESA as a result of a combination of habitat curtailment and modification, overutilization (i.e., being taken as bycatch) in commercial fisheries, and the inadequacy of regulatory mechanisms in ameliorating these impacts and threats.

The modification and curtailment of Atlantic sturgeon habitat resulting from dredging and degraded water quality is contributing to the status of the South Atlantic DPS. Maintenance dredging is currently modifying Atlantic sturgeon nursery habitat in the Savannah River and modeling indicates that the proposed deepening of the navigation channel will result in reduced DO and upriver movement of the salt wedge, curtailing spawning habitat. Dredging is also modifying nursery and foraging habitat in the St. Johns River. Reductions in water quality from terrestrial activities have modified habitat utilized by the South Atlantic DPS Non-point source inputs are causing low DO in the Ogeechee River and in the St. Marys River, which completely eliminates juvenile nursery habitat in summer. Low DO has also been observed in the St. Johns River in the summer. Sturgeon are more sensitive to low DO and the negative (metabolic, growth, and feeding) effects caused by low DO increase when water temperatures are concurrently high, as they are within the range of the South Atlantic DPS. Additional stressors arising from water allocation and climate change threaten to exacerbate water quality problems that are already present throughout the range of the South Atlantic DPS. Large withdrawals of over 240 million gallons per day mgd of water occur in the Savannah River for power generation and municipal uses. However, users withdrawing less than 100,000 gallons per day (gpd) are not required to get permits, so actual water withdrawals from the Savannah and other rivers within the range of the South Atlantic DPS are likely much higher. The removal of large amounts of water from the system will alter flows, temperature, and DO. Water shortages and "water wars" are already occurring in the rivers occupied by the South Atlantic DPS and will likely be compounded in the future by population growth and potentially by climate change. Climate change is also predicted to elevate water temperatures and exacerbate nutrient-loading, pollution inputs, and lower DO, all of which are current stressors to the South Atlantic DPS.

Overutilization of Atlantic sturgeon from directed fishing caused initial severe declines in Atlantic sturgeon populations in the Southeast, from which they have never rebounded. Further, continued overutilization of Atlantic sturgeon as bycatch in commercial fisheries is an ongoing impact to the South Atlantic DPS. The loss of large subadults and adults as a result of bycatch impacts Atlantic sturgeon populations because they are a long-lived species, have an older age at maturity, have lower maximum fecundity values, and a large percentage of egg production occurs later in life. Little data exist on bycatch in the Southeast and high levels of bycatch underreporting are suspected. Further, a total population abundance for the DPS is not available, and it is therefore not possible to calculate the percentage of the DPS subject to bycatch mortality based on the available bycatch mortality rates for individual fisheries. However, fisheries known to incidentally catch Atlantic sturgeon occur throughout the marine range of the species and in some riverine waters as well. Because Atlantic sturgeon mix extensively in marine waters and may access multiple river systems, they are subject to being caught in multiple fisheries throughout their range. In addition, stress or injury to Atlantic sturgeon taken as bycatch but released alive may result in increased susceptibility to other threats, such as poor water quality (e.g., exposure to toxins and low DO). This may result in reduced ability to perform major life functions, such as foraging and spawning, or even post-capture mortality.

As a wide-ranging anadromous species, Atlantic sturgeon are subject to numerous Federal (U.S. and Canadian), state and provincial, and inter-jurisdictional laws, regulations, and agency activities. While these mechanisms have addressed impacts to Atlantic sturgeon through directed fisheries, there are currently no mechanisms in place to address the significant risk posed to Atlantic sturgeon from commercial bycatch. Though statutory and regulatory mechanisms exist that authorize reducing the impact of dams on riverine and anadromous species, such as Atlantic sturgeon, and their habitat, these mechanisms have proven inadequate for preventing dams from blocking access to habitat upstream and degrading habitat downstream. Further, water quality continues to be a problem in the South Atlantic DPS, even with existing controls on some pollution sources. Current regulatory regimes are not necessarily effective in controlling water allocation issues (e.g., no permit requirements for water withdrawals under 100,000 gpd in Georgia, no restrictions on interbasin water transfers in South Carolina, the lack of ability to regulate non-point source pollution.)

In the 2023 5-year review for the South Atlantic DPS, NMFS SERO reviewed and considered new information for the DPS that has become available since this DPS was listed as endangered in February 2012. In the review, NMFS concluded that the South Atlantic DPS' demographic risk is “High” because of its productivity (i.e., relatively few adults compared to historical levels and irregular spawning success), abundance (i.e., riverine populations vary significantly and abundance is generally low in the DPS, overall), and spatial distribution (i.e., riverine populations and connectivity vary, creating inconsistent population coverage across the DPS and potentially limited ability to repopulate extirpated river populations). However, NMFS also concluded that the South Atlantic DPS’ potential to recover is also “High” because man-made threats that have a major impact on the species’ ability to persist have been identified (e.g., bycatch in federally-managed fisheries, dams blocking access to spawning habitat, dredging, vessel strikes), the DPS’ response to those threats are well understood, management or protective actions to address major threats are primarily under U.S. jurisdiction or authority, and management or protective actions are technically feasible even if they require further testing (e.g., gear modifications to minimize dredge or fishing gear interactions).The review includes a summary of additional information available since the listing determination, including information on life history and threats. Based on the best scientific and commercial data available at the time of the review, the review concluded that no change to the listing status is warranted. (NMFS 2023b).

6.0 ENVIRONMENTAL BASELINE

The “environmental baseline” “refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early Section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The impacts to listed species or designated critical habitat from Federal agency activities or existing Federal agency facilities that are not within the agency's discretion to modify are part of the environmental baseline.” (50 CFR §402.02). “Early” consultation in this definition refers to “a process requested by a Federal agency on behalf of a prospective applicant under section 7(a)(3) of the Act” (50 CFR§§402.02, 402.11) which is governed by formalized procedures set forth in 50 CFR§402.11 that are separate and distinct from those set forth in 50 CFR§402.14 for formal consultations initiated under ESA Section 7(a)(2). “Early consultation” under 50 CFR §402.11 and ESA Section 7(a)(3) should not be confused with formal consultation initiated and in its early stages or planned for initiation under 50 CFR§402.14 ESA Section 7(a)(2). Only projects that have completed “formal consultation” under ESA Section 7(a)(2) or completed “early consultation” under ESA Section 7(a)(3) are included in the environmental baseline for this Opinion.

There are a number of existing activities that regularly occur in various portions of the action area, including operation of vessels, and federal and state authorized fisheries. Other activities that occur occasionally or intermittently include scientific research, military activities, and geophysical and geotechnical surveys. There are also environmental conditions caused or exacerbated by human activities (i.e., water quality and noise) that may affect listed species in the action area. Some of these stressors result in mortality or serious injury to individual animals (e.g., vessel strike, fisheries), whereas others result in non-lethal impacts or impacts that are indirect. For all of the listed species considered here, given their extensive movements in and out of the action area and throughout their range as well as the similarities of stressors throughout the action area and other parts of their range, the status of the species in the action area is the same as the rangewide status presented in Section 5.0 *Status of the Species* of this Opinion. Below, we describe the conditions of the action area, present a summary of the best available information on the use of the action area by listed species, and address the impacts to listed species of federal, state, and private activities in the action area that meet the definition of "environmental baseline." Consistent with that definition, future offshore wind projects, as well as activities caused by aspects of their development and operation, that are not the subjects of a completed Section 7 consultation are not in the Environmental Baseline for the SouthCoast Wind project. All planned and reasonably foreseeable offshore wind projects proposed for review and approval by BOEM will undergo a future formal ESA Section 7 consultation when initiation is requested. When an ESA Section 7 consultation is completed on a wind project, the effects of the action associated with that project would be considered in the *Environmental Baseline* for the next wind project in line for formal Section 7 consultation. Thus, all offshore wind projects and associated activities that have undergone and completed the formal ESA Section 7 process are included in the environmental baseline of this Opinion. The SouthCoast Wind project will then be included in the environmental baseline for the ESA Section 7 reviews for future offshore wind projects to the extent its effects on listed species may occur in the action area for those future projects.

Summary of Environmental and Ecosystem Conditions in the southern New England Region
As described above in Section 3.4, the action area includes the WDA (i.e., the WFA and the cable routes to shore), project-related vessel routes in the identified portion of the U.S. EEZ along the Atlantic coast, and the geographic extent of effects caused by project-related activities in those areas. The SouthCoast WDA is located within multiple defined marine areas. The broadest area, the U.S. Northeast Shelf Large Marine Ecosystem, extends from the Gulf of Maine to Cape Hatteras, North Carolina (Kaplan 2011). The WDA is located within the Southern New England sub-region of the Northeast U.S. Shelf Ecosystem, which is distinct from other regions based on differences in productivity, species assemblages and structure, and habitat features (Cook and Auster 2007). The southern New England region is generally defined as the area south of Martha's Vineyard and Nantucket to the shelf edge and bounded to the east by Nantucket Shoals and Block Island to the west. The region is a dynamic area between southward flowing cool arctic waters and northward flowing warm tropical waters, with complex seasonal physical dynamics, which support a diverse marine ecosystem. The physical oceanography of this region is influenced by a variety of shelf processes, including winds, waves, currents, tides, temperature, stratification as well as local bathymetry, freshwater input from multiple rivers and estuaries, large-scale atmospheric patterns, and tropical and winter coastal storm events. Weather-driven surface currents, fronts, upwelling, tidal mixing, and estuarine outflow all contribute to driving water movement both at local and regional scales (Kaplan 2011). These dynamic regional ocean properties support a diverse and productive ecosystem that undergoes changes across multiple time scales (i.e. hourly, daily, monthly, and seasonally).

In the waters of the SouthCoast Wind WFA and surrounding areas along the continental shelf, the broad, year-round pattern of water movement is generally understood. Referred to as the Shelf Break Jet, cold, fresh, nutrient-rich water originating from the Newfoundland Shelf and the Labrador Current flows south along the western margins of the Gulf of Maine due to a cyclonic gyre before splitting near the northern portion of the Great South Channel (east of Cape Cod), with one branch flowing northeast along the northern edge of Georges Bank, and the other flowing west over and around the outer edge of Nantucket Shoals. The flow of water continues westward following bathymetric contours in southern New England and along the continental shelf towards the Mid-Atlantic Bight. This westward non-tidal circulation flow is constant with little variability between seasons (Bigelow 1927, Pettigrew et al. 2005, Kraus, Kenney and Thomas 2019). Tidally driven currents also play an important role in the movement and mixing of water in the greater southern New England region and more specifically the development of frontal activity on and around Nantucket Shoals. The southern New England region is characterized by rotary currents which change their direction of flow in an elliptical shape over the tidal cycle (Le Lacheur et al. 1924, He and Wilkin 2006, White and Viet 2020). The seasonal wind patterns over the southern New England region are similar to the greater Mid-Atlantic Bight region. During the winter months into early spring, the primary wind direction is from the northwest and shifts to southwest from the spring through the summer before turning back to the northwest (Wood et al. 2014). Primary production in the region occurs on a seasonal scale with phytoplankton blooms occurring in the winter and spring during well-mixed conditions. Primary production decreases during stratified conditions in the summer while primary production in the fall corresponds with the breakdown of stratification (Schofield et al. 2008).

On a seasonal scale, the greater Mid-Atlantic Bight region experiences one of the largest transitions in stratification in the entire Atlantic Ocean (Castelao, Glenn, and Schofield, 2010). Starting in the late spring, a strong thermocline develops at approximately 20 m depth across the middle to outer shelf, and forms a thermally isolated body of water known as the “cold pool” which shifts annually but generally extends from the waters of southern New England (in some years, the SouthCoast Wind WFA is on the northern edge of the cold pool) to Cape Hatteras. Starting in the fall, the cold pool breaks down and transitions to cold and well-mixed conditions that last through the winter (Houghton et al. 1982). The cold pool supports prey for a number of ESA listed species, both directly through providing habitat and indirectly through its influence on regional biological oceanography, which supports a productive ecosystem (Kane 2005, Chen et al. 2018, Winton et al. 2018). The Mid-Atlantic Bight region also experiences upwelling in the summer driven by southwest winds associated with the Bermuda High (Glenn & Schofield 2003; Glenn et al. 2004). Cold nutrient-rich water from the cold pool can be transported by upwelling events to surface and nearshore waters. At the surface, this cold water can form large phytoplankton blooms, which support many higher trophic species (Sha et al. 2015).

Plankton species are well adapted to take advantage of the variable seasonality of the regional ecosystem, and support the upper food web for species such as pelagic fish, sea turtles, and marine mammals (Kenney and Vigness-Raposa 2010, Pershing and Stamieszkin 2019). Taken together, zooplankton abundance patterns and energy density assessments suggest that right whale foraging in southern New England is not solely focused on *Calanus finmarchicus*, but instead involves foraging on a mix of seasonally varying copepods, similar to Cape Cod Bay. Zooplankton distribution and abundance in the southern New England region (the region that includes the SouthCoast WDA) varies seasonally. A review of NEFSC Ecosystem Monitoring (EcoMon) data from 1977-2023, using EcoMon strata 18 through 25 that cover the continental shelf from western Long Island to Nantucket Shoals, shows that three taxa dominate the annual catch: *Centropapges typicus* (24%), *Calanus finmarchicus* (14%), and *pseudocalanus* species (12%), together making up about half of sampled zooplankton abundance. However, over 40 additional taxa make up the remaining 50% of the catch, with no species tallying more than 4%, not including a number of smaller species that slip through the 333 micron mesh bongo nets used for this sampling (Turner and Weig 2023). There is also substantial variability on a tow by tow basis, with a relatively small number of net tows containing extraordinarily high abundances.

The three most dominant taxa in terms of regional abundance show differing but somewhat overlapping seasonal peaks in abundance. The 1977-2023 time series shows clear seasonal patterns, although for any particular year seasonal transitions from one numerically dominant species to another exhibits temporal variability. *Centropages typicus* generally has its greatest abundance in the late fall and early winter, making up 44% of catch from December through February and *Psuedocalanus spp.* typically peaks in late winter and early spring. *Calanus finmarchicus* abundance usually peaks in April with higher abundances in spring and summer but very limited abundance from September through February. Right whales are often found in their largest aggregations around Nantucket Shoals during January and February when *Calanus finmarchicus* abundances are low (Johnsen et al. 2021). However, among the limited *Calanus finmarchicus* sampled in January (most net tows occurred during 1984-1993), there was a high proportion of stage 5 *Calanus finmarchicus*, the most energy dense stage for this species.

An examination of abundance patterns of zooplankton across time does not show any distinct regime shifts occurring in a particular year. But over time, the week of the year when the system transitioned from a community numerically dominated by *Centropages typicus* to one numerically dominated by *Psuedocalanus spp.*moved later in the spring, potentially reflecting an overall regional increase in abundance in *Centropages typicus* in the first half of the year. No strong increasing or decreasing trends were detected in *Calanus finmarchicus* over the 1977-2023 time series.

Work assessing zooplankton energy density in the region has shown that *Calanus finmarchicus* in the Nantucket Shoals area had significantly lower lipid content and energy density than Canadian foraging grounds (Helenius et al. 2023, Helenius et al. *in review)*. However, an assessment of EcoMon bongo net samples during the spring of 2023 showed that areas in southern New England had a high bulk plankton energy density per volume despite being much lower in lipid content than the Gulf of Maine, this may be due to the concentration of plankton in a shallower environment (Jacobsen *unpublished data*). Assessments of energy density in nearby areas illustrated that non-*Calanus* species (e.g., *Centropages typicus*) could reach abundances that would provide suitable energy density for right whale foraging (Carlowicz Lee et al. 2024).

The Nantucket Shoals area has complex bathymetry. As noted above, the Shelf Break Jet transports cold, nutrient rich water originating from northern latitudes before splitting with one branch flowing northeast along the northern edge of Georges Bank, and the other flowing west over and around the outer edge of Nantucket Shoals. Nantucket Shoals and nearby Georges Bank share similar physical characteristics that enhance and concentrate primary and secondary production and higher trophic species (White and Viet 2020). The Shoals itself is a relatively shallow and sandy area consisting of shifting sand features that move relative to the dynamic nature of water movement in the region. A northeastward propagating tidal wave causes upwelling, frontal activity, convergence, and a rotary current around Nantucket Shoals due to the predominant direction of water movement and the shallow bathymetry of the Shoals relative to the surrounding waters of southern New England (White and Viet 2020). A tidal mixing front has been identified along the western side of Nantucket Shoals which corresponds with aggregations of marine species including seabirds, fish, sea turtles, and marine mammals which forage around the physical and oceanographic features (Loder and Greenberg 1986, He and Wilkin 2006, Dodge et al. 2014, White and Viet 2020, Quintana-Rizzo et al. 2021). Studies have estimated the location of the frontal zone, placing it between the 25-50 m isobaths (Loder and Greenberg 1986, He and Wilkin 2006, White and Viet 2020, SouthCoast COP Appendix F4). The front is a dynamic feature that forms due to the interaction of the shoaling bathymetry and the flow of water in the region. Though plankton are mobile, physical and oceanographic features (e.g. tidal mixing fronts, thermal fronts, freshwater plumes, internal waves, stratification, horizontal and vertical currents, and bathymetry) are the primary drivers that control aggregations and concentrate them by orders of magnitude (Pershing and Stamieszkin 2019, Kraus et al. 2019, Sorochan et al. 2021). The mixing of warm Gulf Stream waters and cooler waters from the Shelf Break Jet coupled with local meteorological oceanographic conditions and the shallow bathymetry on the Shoals and the steep change in bathymetry surrounding the Shoals creates a nutrient-rich environment, supporting a productive marine ecosystem with oceanographic features aggregating prey for a variety of higher trophic species, including North Atlantic right whales (Ullman and Cornillon 2001, White and Viet 2020, Quintana-Rizzo et al. 2021).

ESA listed species in the southern New England region (the region that includes both the RI/MA WEA and MA WEA and Nantucket Shoals) primarily feed on five prey resources - zooplankton, pelagic fish, gelatinous organisms/cephalopods, marine vegetation, and benthic invertebrates. Of the listed species in the area, North Atlantic right whales are the only obligate zooplanktivores. Sei and fin whales are often observed during the spring and summer throughout the RI/MA WEA and MA WEA, with feeding behavior observed during both periods (Kraus et al. 2016, Stone et al. 2017), however both species eat small schooling fish as well as zooplankton and cephalopods and their distribution is not as well associated with oceanographic features that concentrate zooplankton. Blue whales, which occur primarily along the shelf break rather than on the shelf where the SouthCoast Wind WFA is located, feed primarily on krill but also feed on fish and zooplankton. The distribution of *Calanus* sp. (the primary forage of right whales) is largely driven by season, water movement, and their daily vertical migration (Baumgartner et al. 2007). Other listed species, which eat fish, cephalopods, crustaceans, and marine vegetation, are not as closely tied to physical oceanographic features that concentrate prey, given those species' prey are either more stationary on the seafloor or are more able to move independent of typical ocean currents. While forage fish species do move independent of ocean currents, many of these species prey on plankton. As mentioned above, currents flow into southern New England waters from the Gulf of Maine; these currents are thought to transport *Calanus* sp. into the area, however, southern New England hosts a diverse suite of zooplankton species (Johnson et al. 2006, Ji et al. 2009, Bi et al. 2014). Oceanographic and physical features in the southern New England region then act to concentrate *Calanus* sp. and other copepods. Little is confirmed about the specific oceanographic processes driving right whale feeding habitat in the southern New England region, but right whale distribution is likely linked to the distribution and availability of planktonic prey distributed and aggregated by currents and oceanographic conditions (Pendleton et al. 2009). Similarly, the distribution of leatherback sea turtles is linked to planktonic prey resources (Dodge et al. 2014).

Water depths range from 37.1 m to 63.5 m in the WDA (BOEM 2024); sea surface temperatures vary seasonally from approximately 41.7 °F (5.4 °C) in winter to 63.5 °F (17.5 °C) in summer (BOEM 2024). The seafloor in the WDA is predominantly composed of unconsolidated sediments ranging from silt and fine-grained sands to gravel. In general, finer substrates occur in low-current areas while coarser substrates occur in higher-current areas. The type of motion present in a high current area creates a dynamic habitat supporting mobile plants and animals that are accustomed to a certain degree of natural disturbance and are generally resilient to change. Coarser materials on the seafloor in these high current areas include gravel, cobble, and boulders. Conversely, the mobile sediment habitat is less conducive to species that live on, or are attached to, the seafloor making their occurrence in the action area uncommon. Finer sediments are usually found among discontinuous patches of sand. High current areas occur in regions such as the Muskeget Channel, the ECC, and Nantucket Sound. This is supported by the site-specific benthic surveys which only identified hard bottom and complex habitat in the ECC with greatest abundance in the Muskeget Channel (BOEM 2024). Eelgrass was identified in the ECC near shore at the Falmouth landing site (BOEM 2024).

6.1 Summary of Information on Listed Large Whale Presence in the Action Area

North Atlantic right whale (Eubalaena glacialis)
North Atlantic right whale presence and behavior in the action area is best understood in the context of their range. North Atlantic right whales occur in the Northwest Atlantic Ocean from calving grounds in coastal waters of the southeastern United States to feeding grounds in New England waters into Canadian waters and the Canadian Bay of Fundy, Scotian Shelf, and Gulf of St. Lawrence extending to the waters of Greenland and Iceland (Hayes et al. 2022; 81 FR 4837). The few published sightings of right whales in the Gulf of Mexico (Moore and Clark 1963, Schmidly and Melcher 1974, Ward Geiger et al. 2011) represent either geographic anomalies or a more extensive historic range beyond the sole known calving and wintering ground in the waters of the southeastern U.S. (Waring et al. 2009; 81 FR 4837). The Gulf of Mexico is not considered part of the species range (NMFS 2015; 81 FR 4837) and no right whales are expected to occur in the Gulf of Mexico portion of the action area.

In the late fall, pregnant female right whales move south to their calving grounds off Georgia and Florida, while the majority of the population likely remains on the feeding grounds or disperses along the eastern seaboard. There is at least one case of a calf apparently being born in the Gulf of Maine (Patrician et al. 2009), and another newborn was detected in Cape Cod Bay in 2013 (CCS, unpublished data, as cited in Hayes et al. 2022); however, calving outside of the southeastern U.S. is considered to be extremely rare. A review of visual and passive acoustic monitoring data in the western North Atlantic demonstrated nearly continuous year-round presence across their entire habitat range (for at least some individuals), including in locations previously thought to be used only seasonally by individuals migrating along the coast (e.g., waters off New Jersey and Virginia). This suggests that not all of the population undergoes a consistent annual migration (Bort et al. 2015, Cole et al. 2013, Davis et al. 2017, Hayes et al. 2022, Leiter et al. 2017, Morano et al. 2012, Whitt et al. 2013). Surveys have demonstrated several areas where North Atlantic right whales congregate seasonally, including the coastal waters of the southeastern U.S.; the Great South Channel; Jordan Basin; Georges Basin along the northeastern edge of Georges Bank; Cape Cod; Massachusetts Bay; and the continental shelf south of New England (Brown et al. 2002, Cole et al. 2013, Hayes et al. 2020, Leiter et al. 2017). Several recent studies (Meyer-Gutbrod et al. 2015, 2021, Davis et al. 2017, Davies et al. 2019, Gowan et al. 2019, Simard et al. 2019) suggest spatiotemporal habitat-use patterns are in flux both with regards to a shift northward (Meyer-Gutbrod et al. 2021), changing migration patterns (Gowan et al. 2019), as well as changing numbers in existing known high-use areas (Davis et al. 2017, 2019, 2020).

North Atlantic right whales feed on extremely dense patches of certain copepod species, primarily the late juvenile developmental stage of *C. finmarchicus*. These dense patches can be found throughout the water column depending on time of day and season. They are known to undergo daily vertical migration where they are found within the surface waters at night and at depth during daytime to avoid visual predators. North Atlantic right whales' diving behavior is strongly correlated to the vertical distribution of *C. finmarchicus*. Baumgartner et al. (2017) investigated North Atlantic right whale foraging ecology by tagging 55 whales in six regions of the Gulf of Maine and southwestern Scotian Shelf in late winter to late fall from 2000 to 2010. Results indicated that on average North Atlantic right whales spent 72 percent of their time in the upper 33 feet (10 meters) of water and 15 of 55 whales (27 percent) dove to within 16.5 feet (5 meters) of the seafloor, spending as much as 45 percent of the total tagged time at this depth.

The distribution of right whales is linked to the distribution of their principal zooplankton prey, calanoid copepods (Baumgartner and Mate 2005, NMFS 2005, Waring et al. 2012, Winn et al. 1986). New England waters are important feeding habitats for right whales (Hayes et al. 2020). Right whale calls have been detected by autonomous passive acoustic sensors deployed between 2005 and 2010 at three sites (Massachusetts Bay, Stellwagen Bank, and Jeffreys Ledge) in the southern Gulf of Maine (Morano et al. 2012, Mussoline et al. 2012). Comparisons between detections from passive acoustic recorders and observations from aerial surveys in Cape Cod Bay between 2001 and 2005 demonstrated that aerial surveys found whales on approximately two-thirds of the days during which acoustic monitoring detected whales (Clark et al. 2010).

Recent changes in right whale distribution (Kraus et al. 2016) are driven by warming of deep waters in the Gulf of Maine (Record et al. 2019). Prior to 2010, right whale movements followed the seasonal occurrence of the late stage, lipid-rich copepod *C. finmarchicus* from the western Gulf of Maine in winter and spring to the eastern Gulf of Maine and Scotian Shelf in the summer and autumn (Beardsley et al. 1996, Mayo and Marx 1990, Murison and Gaskin 1989, Pendleton et al. 2009, Pendleton et al. 2012). Recent surveys (2012 to 2015) have detected fewer individuals in the Great South Channel and the Bay of Fundy, and additional sighting records indicate that at least some right whales are shifting to other habitats, suggesting that existing habitat use patterns may be changing (Weinrich et al. 2000; Cole et al. 2007, 2013; Whitt et al. 2013; Khan et al. 2014). Warming in the Gulf of Maine has resulted in changes in the seasonal abundance of late-stage *C. finmarchicus,* with record high abundances in the western Gulf of Maine in spring and significantly lower abundances in the eastern Gulf of Maine in late summer and fall (Record et al. 2019). Baumgartner et al. (2017) discuss that ongoing and future environmental and ecosystem changes may displace *C. finmarchicus* from the Gulf of Maine and Scotian Shelf. The authors also suggest that North Atlantic right whales are dependent on the high lipid content of calanoid copepods from the Calanidae family (i.e., *C. finmarchicus, C. glacialis, C. hyperboreus*), and would not likely survive year-round only on the ingestion of small, less nutritious copepods in the area (i.e., *Pseudocalanus* spp., *Centropages* spp., *Acartia* spp., *Metridia* spp.). It is also possible that even if *C. finmarchicus* remained in the Gulf of Maine, changes to the water column structure from climate change may disrupt the mechanism that causes the very dense vertically compressed patches that North Atlantic right whales depend on (Baumgartner et al. 2017). One of the consequences of these environmental changes has been a shift of right whales out of habitats such as the Great South Channel and the Bay of Fundy, and into areas such as the Gulf of St. Lawrence in the summer and waters of southern New England primarily in the winter and spring, however, right whales have been observed there in all seasons. (NMFS NEFSC, unpublished data, Kraus et al. 2016b, Leiter et al. 2017, Stone et al. 2017, Quintana-Rizzo et al. 2021, Estabrook et al. 2022, O'Brien et al. 2022), with observations of foraging in both areas. Since 2010, the right whale population has been in decline and has experienced an ongoing UME since 2017, primarily caused by ship strikes and entanglement in fishing gear. The species faces sub-lethal stressors (i.e. injury from ship strike, chronic entanglement) that impact their fitness. North Atlantic right whale body length has also had an observed decline with body lengths decreasing since 1986 (Stewart et al. 2021).

North Atlantic right whale Presence in the SouthCoast Wind WDA and Surrounding Waters

Since around 2010, North Atlantic right whales have been sighted more frequently in southern New England waters than in previous time periods (Meyer-Gutbrod et al. 2022, O'Brien et al. 2022). This timing corresponds with a shift in the annual movement of right whales that is linked to an oceanographic regime shift (Meyer-Gutbrod et al. 2021).

There is a seasonal dynamic to right whale habitat use in the southern New England region, with some inter-annual variability. Right whales predominantly occur on the middle and southwestern parts of Nantucket Shoals and the western and southern edges of the Shoals during the fall (September – November), remain in this general area in the highest densities during the winter (December – February) and then shift their distribution to areas across portions of the RI/MA and MA WEAs and waters immediately south throughout the spring (March – May). In the spring, right whales have been sighted in and immediately adjacent to the SouthCoast Wind WFA (Stone et al. 2017, Quintana-Rizzo et al. 2021). Summer (June – August) is when right whale density is lowest in the southern New England region generally, and in the SouthCoast Wind WFA specifically. In more recent years, right whales have been observed on Nantucket Shoals starting in August with different individuals occurring throughout the southern New England region through the spring. However, right whales have been both sighted and detected year-round throughout the entire southern New England region (Estabrook et al. 2022, O'Brien et al. 2022, Van Parijs et al. 2023). Between 2013-2019, both estimated right whale abundance and unique individuals in SNE were shown to be increasing (O'Brien et al. 2022). North Atlantic right whales use the southern New England region for migration as well as feeding and socializing; observations of both feeding behavior and surface active groups have been observed in every season (Kraus et al. 2016, Leiter et al. 2017, Stone et al. 2017, Quintana-Rizzo et al. 2021, Estabrook et al. 2022, O'Brien et al. 2022). In addition to year-round habitat use, southern New England has emerged as a core winter feeding ground across their range. Mean residency time of individual right whales in the southern New England area is estimated to be 1-2 weeks (Quintana-Rizzo et al. 2021). Both the estimated abundance of right whales and unique individuals per unit of survey effort increased in southern New England from 2013-2019 (O'Brien et al. 2022). Quintana-Rizzo et al. found the annual percentage of right whales identified varied between 4 and 53% (13 ± 4%) of the minimum right whale population between

2011-2019 and a recent analysis showed approximately 60% of the population used the southern New England habitat in winter and spring of 2023 alone (McKenna et al. 2023). A review of North Atlantic right whale sightings data in southern New England from 2010-2021 shows a range of demographic patterns. Since 2010 sightings of all age and sex classes (male, female, adult, juvenile, and calves) have increased in the region with sightings of adult males and adult non-reproductive females tripling over this period. Relative to the total right whale population, the population has increased their use of southern New England with over 50% of the male and female population sighted each year since 2017. Use of the region has also increased two-fold for reproductive females, a much smaller class of the total population. The trend of reproductive female use in southern New England has increased since 2010, with approximately one-third of reproductive females sighted each year since 2017. In a review of aerial survey data collected in the southern New England region from 2011-2015, Leiter et al. 2017 found of the 196 known individuals, 32 (16%) were documented only in the southern New England region and not in any other habitat during the study period, 35% were females, 58% were males, and the remainder were of unknown sex. Of the 188 individuals that had assigned age classes, 64% were adults and 32% were juveniles (six individuals were classified as calves at their time of sighting). During the study period, 34 different reproductive females were observed (Leiter et al. 2017). Quintana-Rizzo et al. 2021 also assessed right whale demographics in the southern New England region using data from 2011-2019 and found that the ratio of adults to juveniles in the region was the same as in the population as a whole during the study. The mean annual proportion of males was 57% and 39% females. Both reproductive females and conceptive females were seen in the region, with 42% of the reproductively active females known to be alive during the study were sighted in the region, and 17 individuals were re-sighted in multiple years. The overall yearly proportions of reproductively active females varied from 0.25 to 0.57 (Quintana-Rizzo et al. 2021).

The overall increase in habitat use by the entire population, and reproductive females specifically suggests that the habitat in this area has a high value to the right whale population. Given the physical and biological characteristics of the regional oceanography that enhance productivity and aggregate prey as well as the proportion of the population sighted each year and sightings of feeding right whales year round, the southern New England region, specifically Nantucket Shoals appears to provide a unique ecological function that supports key foraging behaviors for the right whale population.

In addition to observational data, quantitative analyses have established southern New England and Nantucket Shoals specifically, as an area of high use. A species distribution model that incorporated the primary prey (*Calanus finmarchicus*) of North Atlantic right whales and environmental covariates predicted areas of high foraging habitat suitability in southern New England (Pendelton et al. 2012), and a separate density model (Roberts et al. 2024) for right whales also predicted persistent areas of high density for right whales in southern New England waters and seasonally in the SouthCoast Wind WFA. According to Roberts et al. 2024, the Nantucket Shoals area shows persistent North Atlantic right whale density and seasonally extends west across the lease areas in southern New England. The SouthCoast WFA is directly southwest of Nantucket Shoals. Model outputs suggest that 23% of the right whale population is present in southern New England from December through May, and the mean residence time has increased to an average of 13 days during these months (Quintana-Rizzo et al., 2021). High use areas for North Atlantic right whales (also referred to in some literature as “hotspots,” which are often defined as season–period combinations with greater than 10 right whale sightings and clusters within a 90% confidence level) overlap with the SouthCoast Wind WFA during the winter and spring (Quintana-Rizzo et al. 2021). During the winter (December – February) season from 2017-2019, the northeast portion of the WFA was identified as a high-use area for right whales. During spring (March – May) during the periods of 2011- 2015 and 2017-2019, the northeast portion of the SouthCoast Wind WFA and adjacent waters to the north, east, and west were high-use areas for right whales, with both feeding and social behavior (social active groups) observed (Leiter et al. 2017, Quintana-Rizzo et al. 2021). The authors conclude that the mixture of movement patterns within the population and the geographical location of the study area suggests that the area could be a feeding location for whales that stay in the mid-Atlantic and north during the winter–spring months and a stopover site for whales migrating to and from the calving grounds (Quintana-Rizzo et al. 2021). Estabrook et al. (2022) reviewed acoustic data from 2011-2015 focused on the RI/MA and MA WEA, which includes the SouthCoast Wind WFA; they found seasonal variations that were elevated from January to March and lowest during the summer months of July to September. Despite the seasonal variation in detections of right whale upcalls, detections occurred year-round (Estabrook et al. 2022, Van Parijs et al. 2023). The WDA both spatially and temporally overlaps a portion of the migratory Biologically Important Area (BIA), which describes the area within which right whales migrate south to calving grounds generally in November and December, followed by a northward migration into feeding areas east and north of the WDA in March and April (LaBrecque et al., 2015; Van Parijs et al., 2015). High densities of North Atlantic right whales (and leatherback sea turtles) are often observed around the greater Nantucket Shoals area, which acts to aggregate prey for multiple higher trophic species (Dodge et al. 2014, Kraus et al. 2016, Leiter et al. 2017, Stone et al. 2017, and Quintana-Rizzo et al. 2021). The influence of the physical and oceanographic features in the region on prey is particularly relevant to North Atlantic right whales and leatherback sea turtles as their prey is planktonic (copepods and gelatinous organisms, respectively) as these features are the primary drivers that control aggregations and concentrations of plankton. Conclusions about feeding behavior were based on sightings of right whales open-mouthed or just below the surface as feeding at depth could not be confirmed.

The Right Whale Sighting Advisory System (RWSAS) alerts mariners to the presence of right whales, and collects sighting reports from a variety of sources including aerial surveys, shipboard surveys, whale watch vessels, and opportunistic sources (Coast Guard, commercial ships, fishing vessels, and the public). In 2016, North Atlantic right whales were observed in the shelf waters south of Martha's Vineyard and Nantucket during January, February, and May. In 2017, North Atlantic right whales were observed in the shelf waters south of Martha's Vineyard and Nantucket in every month except January, August, and December. In 2018 and 2019, North Atlantic right whales were observed in the shelf waters south of Martha's Vineyard and Nantucket (i.e., the area between the islands and the Nantucket to Ambrose traffic lane) in every month except October; in 2020, right whales were detected in this area from January to March and July to December. No right whales were detected during aerial surveys of this area in June 2020, but right whales were observed in July, August, September, October, November, and December. Sightings data is not available for April and May 2020 as aerial survey operations were affected by pandemic restrictions (see https://whalemap.org/WhaleMap). In 2021, North Atlantic right whales were observed in the shelf waters south of Martha's Vineyard and Nantucket in every month except for June. In 2022, North Atlantic right whales were detected (acoustic or visual) in the shelf waters south of Martha's Vineyard and Nantucket, inshore of the Nantucket to Ambrose traffic lanes, in every month except May and June; From January 2023 through September 2024, there was at least one right whale detected in that area in every month except for July, September, October 2023 and September 2024 (see https://whalemap.org/WhaleMap).

As described in the MMPA ITA Proposed Rule (88 FR 37606, June 8, 2023), the best available information regarding marine mammal densities in the action area is provided by habitat-based density models produced by the Duke University Marine Geospatial Ecology Laboratory (Roberts *et al.*, 2016, 2017, 2018, 2020, 2024). The updated models incorporate additional sighting data, including sightings from the NOAA Atlantic Marine Assessment Program for Protected Species (AMAPPS) surveys from 2010-2016 which included some aerial surveys over the RI/MA & MA WEAs (NEFSC & SEFSC, 2011, 2011b, 2012, 2014, 2014b, 2015, 2016). Roberts et al. (2020) further updated model results for North Atlantic right whales by incorporating additional sighting data and implementing three major changes: Increasing spatial resolution, generating monthly estimates on three time periods of survey data, and dividing the study area into five discrete regions.

The best available information regarding marine mammal densities in the portion of the action area encompassing the WDA is provided by habitat-based density models produced by the Duke University Marine Geospatial Ecology Laboratory, with the most recent updates published as Roberts et al., 2023. SouthCoast used this data to develop mean monthly density estimates for North Atlantic right whales in different parts of the action area; the mean density for each month was determined by calculating the unweighted mean of all 5- by 5-km grid cells partially or fully within the analysis polygon (see Figure 8 in JASCO, 2022 COP Appendix U2). Table 6.1 below includes the mean monthly density estimates for right whales in a 50-km perimeter around the SouthCoast Wind WDA (see Table H-9 in Limpert et al. 2024).

Table 6.1. Average Monthly Density Estimates for North Atlantic right whales within 50 km of the Lease Area Perimeter.

Species	Monthly Densities (animals per 100 km^2)											
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec
North Atlantic right whale	0.750	0.885	0.765	0.666	0.485	0.146	0.093	0.049	0.066	0.078	0.171	0.493

In summary, we anticipate individual right whales to occur year round in the action area in both coastal, shallower waters as well as offshore, deeper waters. We expect these individuals to be moving throughout the action area, making seasonal migrations, foraging in northern parts of the action area when copepod patches of sufficient density are present, especially in the Nantucket Shoals area, and calving during the winter in southern waters of the action area outside of the area where project construction will occur. As noted above, right whales are generally not expected to occur in the Gulf of Mexico with any presence being rare and limited to occasional, sporadic out of range individuals.

Sei whale (Balaenoptera borealis)
In the action area, sei whales are expected to be present in the WDA, most likely in the deeper areas furthest from the coast, and may be present along the oceanic portions of all potential vessel transit routes. The presence and behavior of sei whales in the action area is best understood in the context of their range in the Atlantic, which extends from southern Europe/northwestern Africa to Norway in the east, and from the southeastern United States (or occasionally the Gulf of Mexico and Caribbean Sea; Mead 1977) to West Greenland in the west (Gambell 1977; Gambell 1985b; Horwood 1987). The southern portion of the species' range during spring and summer includes the northern portions of the U.S. EEZ, the Gulf of Maine, Georges Bank, and south of New England (Halpin et al. 2009, Hayes et al. 2017, Hayes et al. 2020). Sei whales are very rare in the Gulf of Mexico with recent sightings limited to stranded individuals in the northern Gulf of Mexico (NMFS 2011). Sei whales are not documented as inhabitants of the Gulf of Mexico in NMFS' stock assessment reports (Waring 2016) and it is extremely unlikely that they would occur along the routes used by project vessels moving to or from ports in the Gulf of Mexico.

Sei whales occurring in the North Atlantic belong to the Nova Scotia stock (Hayes et al. 2020). They can be found in deeper waters of the continental shelf edge waters of the northeastern United States and northeastward to south of Newfoundland (Hain et al. 1985, Prieto et al., 2014). Documented sei whale sightings along the U.S. Atlantic Coast south of Cape Cod are relatively uncommon compared to other baleen whales (CETAP 1982; Kagueux et al. 2010; Hayes et al. 2020). Sei whale sightings in U.S. Atlantic waters are typically centered on mid-shelf and the shelf edge and slope (Olsen et al. 2009). Spring is the period of greatest sei whale abundance in New England waters, with sightings concentrated along the eastern margin of Georges Bank, into the Northeast Channel area, south of Nantucket, and along the southwestern edge of Georges Bank in the area of Hydrographer Canyon (Hayes et al. 2022).

Sei whales often occur along the shelf edge to feed, but also use shallower shelf waters, particularly during certain years when oceanographic conditions force planktonic prey to shelf and inshore waters (Payne et al. 1990, Schilling et al. 1992, Waring et al. 2004). Although known to eat fish in other oceans, sei whales off the northeastern U.S. are largely planktivorous, feeding primarily on euphausiids and copepods (Flinn et al. 2002, Hayes et al. 2017). These aggregations of prey are largely influenced by the dynamic oceanographic processes in the region. LaBrecque et al. (2015) defined a May to November feeding BIA for sei whales that extends from the 82-foot (25-m) contour off coastal Maine and Massachusetts east to the 656-foot (200-m) contour in the central Gulf of Maine, including the northern shelf break area of Georges Bank, the Great South Channel, and the southern shelf break area of Georges Bank from 328 to 6,562 feet (100–2,000 m). This feeding BIA does not overlap with the SouthCoast Wind WDA.

Sei whales may be present in and around the WDA year-round but are most commonly present in the spring and early summer (Davis et al. 2020).[25] Sightings data from 1981 to 2018 indicate that sei whales may occur in the area in relatively moderate numbers during the spring and in low numbers in the summer (North Atlantic Right Whale Consortium 2018). Kraus et al. (2016) and Quintana-Rizzo et al. (2018) report observed sei whales in and near the RI/MA WEA from March through June from 2011 through 2015 and in 2017, respectively, with the timing of peak occurrence varying by year. Sei whales were absent from the area from August through February. In the RI/MA WEA in 2017, sightings were generally concentrated to the south and east of the SouthCoast Wind WDA. This distribution suggests that sei whales are likely to occur in and near the lease area between March and June if recent patterns of habitat use continue. However, no sei whales were observed in the same study area in 2018 (Quintana-Rizzo et al. 2018). During 2020-2021 aerial surveys of the Massachusetts WEA, one sei whale was observed during the spring of 2021 in an area to the southeast of the SouthCoast Wind lease area (O'Brien et al. 2021). Kraus et al. (2016) observed an unusually large number of sei whales during aerial and acoustic surveys of the RI/MA WEA and vicinity that were conducted from 2011 through 2015. Several individuals were observed in the study area from March through June, with peaks in May and June, at a mean abundance ranging from zero to 26 animals (Stone et al. 2017). Quintana-Rizzo et al. (2019) observed a large concentration of sei whales in the area in April, May, and July of 2017 peaking at 29 individuals in May, but none were observed in 2018. O'Brien et al. (2020, 2021a, 2021b) observed several sei whales 40 miles or more to the southeast of the WDA in 2019 but none were observed in the study area in 2020.

As part of the application for an MMPA ITA for the SouthCoast Wind project, Limpert et al. (2024) used data from Roberts et al. (2022) to calculate mean monthly density estimates in different portions of the action area where project noise will occur. In the area within 50 km of the lease area, monthly density of sei whales ranges from 0.011-0.222 sei whales/100 km^2, with the lowest densities from June to March and the highest in April-May.

In summary, we anticipate individual sei whales to occur in the action area year round, with presence in the nearer shore portions of the action area, including the lease and cable corridors, primarily in the spring and fall. The presence of sei whales along vessel transit routes south of the WDA is expected to be rare given the species offshore and more northerly distribution. We expect individuals in the action area to be making seasonal migrations, and to be foraging when krill are present. Foraging adult sei whales are most likely to occur in the WDA but the observation of three adult sei whales with calves in the MA and RI/MA WEA during spring and summer months (Kraus et al. 2016) indicates adult/calf pairs could occasionally be seasonally present in the WDA.

Sperm whale (Physeter macrocephalus)

In the action area, sperm whales may be present along the oceanic portions of all potential vessel transit routes and occasionally in the more offshore portion of the WDA. Sperm whales in the action area belong to the North Atlantic stock. Sperm whales are widely distributed throughout the deep waters of the North Atlantic, primarily along the continental shelf edge, over the continental slope, and into mid-ocean regions (Hayes et al., 2020). They are found at higher

[25] Based on frequency of acoustic detections of sei whales in Davis et al. (2020) designated monitoring region 7: Southern New England and New York Bight. This monitoring region encompasses the lease area. The sei whale detection range of the sensor network extends up to 12.5 miles (20 km).

densities in areas such as the Bay of Biscay, to the west of Iceland, and towards northern Norway (Rogan et al. 2017) as well as around the Azores. This offshore distribution is more commonly associated with the Gulf Stream edge and other features (Waring et al. 1993, Waring et al. 2001). Calving for the species occurs in low latitude waters outside of the action area. Most sperm whales that are seen at higher latitudes are solitary males, with females generally remaining further south.

Northern Gulf of Mexico Stock

In the northern Gulf of Mexico (i.e., U.S. Gulf of Mexico), systematic aerial and ship surveys indicate that sperm whales inhabit continental slope and oceanic waters where they are widely distributed and present year round (Hayes et al. 2021). The best abundance estimate (Nest) for the northern Gulf of Mexico sperm whale is 1,180 (CV=0.22). This estimate is from summer 2017 and summer/fall 2018 oceanic surveys covering waters from the 200-m isobath to the seaward extent of the U.S. EEZ (Garrison et al. 2020). An Unusual Mortality Event (UME) was declared for cetaceans in the northern Gulf of Mexico beginning 1 March 2010 and ending 31 July 2014 (Litz et al. 2014; https://www.fisheries.noaa.gov/national/marine- life-distress/2010-2014-cetacean-unusual-mortality-event-northern-gulf-mexico). It included cetaceans that stranded prior to the Deepwater Horizon (DWH) oil spill, during the spill, and after. Exposure to the DWH oil spill was determined to be the primary underlying cause of the elevated stranding numbers in the northern Gulf of Mexico after the spill (e.g., Schwacke et al. 2014; Venn-Watson et al. 2015; Colegrove et al. 2016; DWH NRDAT 2016 in Hayes et al. 2021). Sperm whales in the Gulf of Mexico experienced increased mortality related to oil exposure resulting from the DWH incident (Hayes et al. 2021).

North Atlantic Stock

Sperm whales are widely distributed throughout the deep waters of the North Atlantic, primarily along the continental shelf edge, over the continental slope, and into mid-ocean regions (Hayes et al., 2020). They are found at higher densities in areas such as the Bay of Biscay, to the west of Iceland, and towards northern Norway (Rogan et al. 2017) as well as around the Azores. This offshore distribution is more commonly associated with the Gulf Stream edge and other features (Waring et al. 1993, Waring et al. 2001). Calving occurs in low latitude waters outside of the action area. Most sperm whales that are seen at higher latitudes are solitary males, with females generally remaining further south.

In the U.S. Atlantic EEZ waters, there appears to be a distinct seasonal distribution pattern (CETAP 1982, Scott and Sadove 1997). In spring, the center of distribution shifts northward to east of Delaware and Virginia and is widespread throughout the central portion of the Mid-Atlantic Bight and the southern portion of Georges Bank. In summer, the distribution of sperm whales includes the area east and north of Georges Bank and into the Northeast Channel region, as well as the continental shelf (inshore of the 100-m isobath) south of New England. In the fall, sperm whale occurrence south of New England on the continental shelf is at its highest level. In winter, sperm whales are concentrated east and northeast of Cape Hatteras.

The average depth of sperm whale sightings observed during the CeTAP surveys was 5,880 ft. (1,792 m) (CETAP 1982). Female sperm whales and young males usually inhabit waters deeper than 3,280 ft. (1,000 m) and at latitudes less than 40° N (Whitehead 2002). Sperm whales feed on larger organisms that inhabit the deeper ocean regions including large- and medium-sized squid, octopus, and medium-and large-sized demersal fish, such as rays, sharks, and many teleosts (NMFS 2015; Whitehead 2002). Although primarily a deep-water species, sperm whales are known to visit shallow coastal regions when there are sharp increases in bottom depth where upwelling occurs resulting in areas of high planktonic biomass (Clarke 1956, Best 1969, Clarke et al. 1978, Jaquet 1996).

Historical sightings data from 1979 to 2018 indicate that sperm whales may occur in and near the RI/MA WEA in the summer and autumn in relatively low to moderate numbers (North Atlantic Right Whale Consortium 2018). Kraus et al. (2016) recorded four sperm whale sightings in and near the RI/MA WEA between 2011 and 2015. Three of the four sightings occurred in August and September 2012, and one occurred in June 2015. Because of the limited sample size, Kraus et al. (2016) were not able to calculate SPUE or estimate abundance in the action area, and specific sighting locations were not provided. No adults were observed foraging or with calves during the 2011-2015 aerial surveys (Kraus et al. 2016).

As part of the COP for the SouthCoast Wind project, JASCO (2022) used data from Roberts et al. (2022) to calculate mean monthly density estimates in different parts of the action area that will experience project noise. In the area within 50-km of the SouthCoast Wind lease area, monthly density of sperm whales ranges from 0.009-0.041 sperm whales/100km^2, with the highest density in July and August.

In summary, individual adult sperm whales are anticipated to occur infrequently in deeper, offshore waters of the North Atlantic portion of the action area primarily in summer and fall months, with a small number of individuals potentially present year round. These individuals are expected to be moving through the RI/MA WEA as they make seasonal migrations, and to be foraging along the shelf break. As sperm whales typically forage at deep depths (500-1,000 m) (NMFS 2015) well beyond that of the lease area, foraging is not expected to occur in the WDA. Additionally, sperm whales may occur along the oceanic portions of vessel transit routes south, north, and east of the WDA, with presence most likely in more offshore waters.

Fin whales (Balaenoptera physalus)

In the action area, fin whales are present in the WDA and may be present along the oceanic portions of some vessel transit routes. Fin whale presence and behavior in the action area is best understood in the context of their range. Fin whale presence in the North Atlantic is limited to waters north of Cape Hatteras, NC. In general, fin whales in the central and eastern Atlantic tend to occur most abundantly over the continental slope and on the shelf seaward of the 200-m isobath (Rørvik et al. 1976 in NMFS 2010). In contrast, off the eastern United States they are centered along the 100-m isobath but with sightings well spread out over shallower and deeper water, including submarine canyons along the shelf break (Kenney and Winn 1987; Hain et al. 1992). Fin whales do not occur in the Gulf of Mexico.

Fin whales occurring in the North Atlantic belong to the western North Atlantic stock (Hayes et al. 2019). Fin whales are migratory, moving seasonally into and out of feeding areas, but the overall migration pattern is complex and specific routes are unknown (NMFS 2018a). The species occur year-round in a wide range of latitudes and longitudes, but the density of individuals in any one area changes seasonally. Thus, their movements overall are patterned and consistent, but distribution of individuals in a given year may vary according to their energetic and reproductive condition, and climatic factors (NMFS 2010a). Fin whales are believed to use the North Atlantic water primarily for feeding and more southern waters for calving. Movement of fin whales from the Labrador/Newfoundland region south into the West Indies during the fall have been reported (Clark 1995). However, neonate strandings along the U.S. Mid-Atlantic coast from October through January indicate a possible offshore calving area (Hain et al. 1992). Thus, their movements overall are patterned and consistent, but distribution of individuals in a given year may vary according to their energetic and reproductive condition, and climatic factors (NMFS 2010).

The northern Mid-Atlantic Bight represents a major feeding ground for fin whales as the physical and biological oceanographic structure of the area aggregates prey. This feeding area extends in a zone east from Montauk, Long Island, New York, to south of Nantucket (LaBrecque et al. 2015, Kenney and Vigness-Raposa 2010; NMFS 2010a) and is a location where fin whales congregate in dense aggregations and sightings frequently occur (Kenney and Vigness-Raposa 2010). Fin whales in this area feed on krill (*Meganyctiphanes norvegica* and *Thysanoessa inermis*) and schooling fish such as capelin (*Mallotus villosus*), herring (*Clupea harengus*), and sand lance (*Ammodytes* spp.) (Borobia et al. 1995) by skimming the water or lunge feeding. This area is used extensively by feeding fin whales from March to October. Several studies suggest that distribution and movements of fin whales along the east coast of the United States is influenced by the availability of sand lance (Kenney and Winn 1986, Payne 1990).

Aerial survey observations collected by Kraus et al. (2016) from 2011 through 2015 and Quintana-Rizzo et al. (2018) in 2017 and 2018 indicate peak fin whale occurrence in the RI/MA WEA from May to August; however, the species may be present at varying densities during any month of the year. During seasonal aerial and acoustic surveys conducted from 2011-2015 in the RI/MA WEA, fin whales were observed every year, and sightings occurred in every season with the greatest numbers during the spring (n = 35) and summer (n = 49) months (Kraus et al., 2016). Observed behavior included feeding and migrating. Despite much lower sighting rates during the winter, a hydrophone array confirmed fin whales presence throughout the year (Kraus et al. 2016). LaBrecque et al. (2015) delineated a BIA for fin whale feeding in an area extending from Montauk Point, New York, to the open ocean south of Martha's Vineyard between the 49-foot (15-m) and 164-foot (50-m) depth contours. This BIA overlaps with the SouthCoast WDA and is used by feeding fin whales from March to October.

As part of BA for the SouthCoast Wind project, Limpert et al. (2024) used data from Roberts et al. (2022) to calculate mean monthly density estimates in portions of the action area where project noise will be experienced. In the area within 50 km of the lease area, monthly density of fin whales ranges from 0.074- 0.472 fin whales/100 km^2, with the lowest density in November and highest density in April-August. This is consistent with regional occurrence timing derived from regional PAM data, which indicate that this species is present and vocalizing in the region throughout the year, (Davis et al. 2020). However, while Davis et al. (2020) found the lowest likelihood of occurrence in May and June, Kraus et al. (2016) observed fewer individuals from September through March. As shown, fin whales are likely to be present in the WDA year round with seasonal variations, and fin whales are likely to have reduced density during the fall.

In summary, we anticipate individual fin whales to occur in the WDA year-round, with the highest numbers in the spring through early fall. We expect these individuals to be making seasonal coastal migrations, and to be foraging during spring and summer months. Fin whales occur year- round in a wide range of latitudes and longitudes, thus they may be present in the oceanic portions of the action area year round.

Blue whales (Balaenoptera musculus)
In the action area, blue whales are present along the oceanic portions of all potential vessel transit routes and are expected to occasionally occur in the more offshore portions of the WDA. Blue whale presence and behavior in the action area is best understood in the context of their range. In the North Atlantic Ocean, the range of blue whales extends from the subtropics to the Greenland Sea. As described in Hayes et al. (2020; the most recent stock assessment report for blue whales), blue whales have been detected and tracked acoustically in much of the North Atlantic with most of the acoustic detections around the Grand Banks area of Newfoundland and west of the British Isles. Photo-identification in eastern Canadian waters indicates that blue whales from the St. Lawrence, Newfoundland, Nova Scotia, New England, and Greenland all belong to the same stock, while blue whales photographed off Iceland and the Azores appear to be part of a separate population (CETAP 1982; Wenzel et al. 1988; Sears and Calambokidis 2002; Sears and Larsen 2002).

Migration patterns for blue whales in the eastern North Atlantic Ocean are poorly understood. However, blue whales have been documented in winter months off Mauritania in northwest Africa (Baines & Reichelt 2014); in the Azores, where their arrival is linked to secondary production generated by the North Atlantic spring phytoplankton bloom (Visser et al. 2011); and traveling through deep-water areas near the shelf break west of the British Isles (Charif & Clark 2009). Blue whale calls have been detected in winter on hydrophones along the mid-Atlantic ridge south of the Azores (Nieukirk et al. 2004). Davis et al. (2020) assessed PAM data on the Atlantic Coast between 2004-2010 and 2011-2014. Using PAM system deployed during 2011-2014, they detected blue whale calls off the coast of Massachusetts and Rhode Island, with seasonal variations. Blue whale vocalizations were detected in the winter months of November to February. There is some evidence of shifts in blue whale distribution, with a decrease in abundance on the Scotian shelf and southern New England mirroring shifts in prey distribution (Davis et al. 2020).

Blue whales do not regularly occur within the U.S. EEZ and typically occur further offshore in areas with depths of 100 m or more (Waring et al. 2010), which is outside of the WDA. Based on the available information summarized above, we expect blue whales to be rare in the WDA with presence limited to transient individuals or small groups in the furthest offshore portion of the WDA. Based on the rarity of detections in nearshore waters, it is reasonable to expect that the presence of blue whales along vessel transit routes between the WDA and coastal ports in MA, RI, and CT is rare.

In summary, individual blue whales are anticipated to occur infrequently in deeper, offshore waters of the action area, with a small number of individuals occurring in the furthest offshore portions of the WDA. These individuals are expected to be moving through and nearby the

WDA as they make seasonal migrations, and to be foraging along the shelf break. The presence of blue whales along the vessel transit routes to and from coastal New England, Mid-Atlantic, and South Atlantic ports is expected to be rare, with presence more likely in areas of the U.S. EEZ further offshore transited by vessels moving between the WDA and more distant ports (i.e., Canada and Europe). No blue whales are expected in the Gulf of Mexico.

6.2 Summary of Information on Listed Sea Turtles in the Action Area

Four ESA-listed species of sea turtles (Leatherback sea turtles, North Atlantic DPS of green sea turtles, Northwest Atlantic Ocean DPS of loggerhead sea turtles, Kemp's ridley sea turtles) make seasonal migrations along the U.S. Atlantic Coast, including into southern New England waters that include the WDA and are expected to occur in the action area. Individuals from all four species are seasonally present in the WDA, typically from late spring/early summer through the fall; these species are also seasonally present in the coastal and oceanic waters that may be transited by project vessels traveling to ports located within Delaware, Maryland, New York, New Jersey, and the Chesapeake Bay. Sea turtles are present year round in the South Atlantic and Gulf of Mexico and their range overlaps with the coastal and oceanic waters that may be transited by project vessels traveling to/from Corpus Christi, Texas and Altamira, Mexico.

The four species of sea turtles considered here are highly migratory. One of the main factors influencing sea turtle presence in mid-Atlantic waters and north is seasonal temperature patterns (Ruben and Morreale 1999) as waters in these areas are not warm enough to support sea turtle presence year round. In general, sea turtles move up the U.S. Atlantic coast from southern wintering areas to foraging grounds as water temperatures warm in the spring. The trend is reversed in the fall as water temperatures cool. By December, sea turtles have passed Cape Hatteras, returning to more southern waters for the winter (Braun-McNeill and Epperly 2002, Ceriani et al. 2012, Griffin et al. 2013, James et al. 2005b, Mansfield et al. 2009, Morreale and Standora 2005, Morreale and Standora 1998, NEFSC and SEFSC 2011, Shoop and Kenney 1992, TEWG 2009, Winton et al. 2018). Water temperatures too low or too high may affect feeding rates and physiological functioning (Milton and Lutz 2003); metabolic rates may be suppressed when a sea turtle is exposed for a prolonged period to temperatures below 8-10° C (George 1997, Milton and Lutz 2003, Morreale et al. 1992). That said, loggerhead sea turtles have been found in waters as low as 7.1-8°C (Braun-McNeill et al. 2008, Smolowitz et al. 2015, Weeks et al. 2010). However, in assessing critical habitat for loggerhead sea turtles, the review team considered the water-temperature habitat range for loggerheads to be above 10° C (79 FR 39855). Sea turtles are most likely to occur in the action area when water temperatures are above this temperature, although depending on seasonal weather patterns and prey availability, they could be also present in months when water temperatures are cooler (as evidenced by fall and winter cold stunning records as well as year round stranding records). Given the warmer water temperatures, sea turtles are present in waters off the U.S. south Atlantic and in the Gulf of Mexico year round.

Regional historical sightings, strandings, and bycatch data indicate that loggerhead and leatherback turtles are relatively common in waters of southern New England, while Kemp's ridley turtles and green turtles are less common (Kenney and Vigness-Raposa 2010). Aerial surveys conducted seasonally, from 2011-2015, in the MA WEA recorded the highest abundance of endangered sea turtles during the summer and fall, with no significant inter-annual variability. For most species of sea turtles, relative density was even throughout the WEA. Sea turtles in the WDA are adults or juveniles; due to the distance from any nesting beaches, no hatchlings occur in the WDA. Similarly, no reproductive behavior is known or suspected to occur in the lease area.

Sea turtles feed on a variety of both pelagic and benthic prey, and change diets through different life stages. Adult loggerhead and Kemp's ridley sea turtles are carnivores that feed on crustaceans, mollusks, and occasionally fish; green sea turtles are herbivores and feed primarily on algae, seagrass, and seaweed; and leatherback sea turtles are pelagic feeders that forage throughout the water column primarily on gelatinivores. As juveniles, loggerhead and green sea turtles are omnivores (Wallace et al. 2009, Dodge et al. 2011, BA - Eckert et al. 2012, https://www.seeturtles.org/sea-turtle-diet, Murray et al 2013, Patel et al. 2016). The distribution of pelagic and benthic prey resources is primarily associated with dynamic oceanographic processes, which ultimately affect where sea turtles forage (Polovina et al. 2006). During late-spring, summer, and early-fall months when water temperatures are suitable, the physical and biological structure of both the pelagic and benthic environment in the lease area and cable corridor provide habitat for both the four species of sea turtles in the region as well as their prey.

Additional species-specific information is presented below. It is important to note that most of these data sources report sightings data that is not corrected for the percentage of sea turtles that were unobservable due to being under the surface. As such, many of these sources represent a minimum estimate of sea turtles in the area.

Leatherback sea turtles

Leatherbacks are a predominantly pelagic species that ranges into cooler waters at higher latitudes than other sea turtles; their large body size makes the species easier to observe in aerial and shipboard surveys. The CETAP regularly documented leatherback sea turtles on the OCS between Cape Hatteras and Nova Scotia during summer months in aerial and shipboard surveys conducted from 1978 through 1988. The greatest concentrations were observed between Long Island and the Gulf of Maine (Shoop and Kenney 1992). AMAPPS surveys conducted from 2010 through 2013 routinely documented leatherbacks in the RI/MA WEA and surrounding areas during summer months (NEFSC and SEFSC 2018, 2022: Palka 2021).

Satellite tagging studies have been used to understand leatherback sea turtle behavior and movement in portions of the action area (Dodge et al. 2014, Dodge et al. 2015, Eckert et al. 2006, James et al. 2005a, James et al. 2005b, James et al. 2006a). These studies show that leatherback sea turtles move throughout most of the North Atlantic from the equator to high latitudes. Key foraging destinations include, among others, the eastern coast of United States (Eckert et al. 2006). Satellite tagging studies provide information on leatherback sea turtle behavior and movement in the action area. These studies show that leatherback sea turtles move throughout most of the North Atlantic from the equator to high latitudes. Based on tracking data for leatherbacks tagged off North Carolina (n=21), many of the tagged leatherbacks spent time in shelf waters from North Carolina, up the Mid-Atlantic shelf and into southern New England and the Gulf of Maine. After coastal residency, some leatherbacks undertook long migrations while tagged. Some migrated far offshore of the Mid-Atlantic, past Bermuda, even as far as the Mid-

Atlantic Trench region. Others went towards Florida, the Caribbean, or Central America (Palka et al. 2021). This data indicates that leatherbacks are present throughout the action area at all depths of the water column and may be present along the vessel transit routes to/from the South Atlantic.

Telemetry studies provide information on the use of the water column by leatherback sea turtles. Based on telemetry data for leatherbacks (n=15) off Cape Cod, Massachusetts, leatherback turtles spent over 60% of their time in the top 33 ft. (10 m) of the water column and over 70% in the top 49 ft. (15 m) (Dodge et al. 2014). Leatherbacks on the foraging grounds moved with slow, sinuous area-restricted search behaviors. Shorter, shallower dives were taken in productive, shallow waters with strong sea surface temperature gradients. They were highly aggregated in shelf and slope waters in the summer, early fall, and late spring. During the late fall, winter, and early spring, they were more widely dispersed in more southern waters and neritic habitats (Dodge et al. 2014). Leatherbacks (n=24) tagged in Canadian waters primarily used the upper 98 ft. (30 m) of the water column and had shallow dives (Wallace et al. 2015).

Leatherbacks tagged off Massachusetts showed a strong affinity to the northeast United States continental shelf before dispersing widely throughout the northwest Atlantic (Dodge et al. 2014). The tagged leatherbacks ranged widely between 39°W and 83°W, and between 9°N and 47°N, over six oceanographically distinct ecoregions defined by Longhurst: the Northwest Atlantic Shelves (n=20), the Gulf Stream (n=16), the North Atlantic Subtropical Gyral West (hereafter referred to as the Subtropical Atlantic, n=15), the North Atlantic Tropical Gyral (the Tropical Atlantic, n=15), the Caribbean (n=6) and the Guianas Coastal (n=7) (Dodge et al. 2014). This data indicates that leatherbacks are present throughout the action area considered here and may be present along the vessel transit routes from Canada and Europe. From the tagged turtles in this study, there was a strong seasonal component to habitat selection, with most leatherbacks remaining in temperate latitudes in the summer and early autumn and moving into subtropical and tropical habitat in the late autumn, winter, and spring. Leatherback turtles might initiate migration when the abundance of their prey declines (Sherrill-Mix et al. 2008).

Dodge et al. (2018) used an autonomous underwater vehicle (AUV) to remotely monitor fine-scale movements and behaviors of nine leatherbacks off Cape Cod, Massachusetts. The "TurtleCam" collected video of tagged leatherback sea turtles and simultaneously sampled the habitat (e.g., chlorophyll, temperature, salinity). Representative data from one turtle was reported in Dodge et al. (2018). During the 5.5 hours of tracking, the turtle dove continuously from the surface to the seafloor (0-66 ft. (0-20 m)). Over a two-hour period, the turtle spent 68% of its time diving, 16% swimming just above the seafloor, 15% at the surface, and 17% just below the surface. The animal frequently surfaced (>100 times in ~2 hours). The turtle used the entire water column, feeding on jellyfish from the seafloor to the surface. The turtle silhouetted prey 36% of the time, diving to near/at bottom, and looking up to locate prey. The authors note that silhouetting prey may increase entanglement in fixed gear if a buoy of float is mistaken for jellyfish (Dodge et al. 2018).

Leatherbacks were the most frequently sighted sea turtle species in monthly aerial surveys of the RI/MA WEA from October 2011 through June 2015 (Kraus et al. 2016). However, leatherback sea turtles showed an apparent preference for the northeastern corner of the WEA, which is consistent with results from a tagging study on leatherbacks in the area (Kraus et al. 2016, Dodge et al., 2014). These results suggest an important seasonal habitat for leatherbacks in southern New England (Kraus et al. 2016, Dodge et al. 2014) that overlaps with a portion of the action area but is outside the WDA. Kraus et al. (2016) recorded 153 observations (161 animals) in monthly aerial surveys, all between May and November, with a strong peak in the fall (see Table 4.7 in the BA). Data from Kraus et al. (2016) indicates that in some parts of the year, leatherbacks would be the most abundant sea turtle species in the WDA, which is consistent with the other information on sea turtle occurrence in the vicinity presented here. Leatherback sightings per unit effort (SPUE) in the RI/MA WEA and vicinity from 2020 to 2021 are displayed by season in Figure 3-6 of the BA (from O'Brien et al. 2022). As shown, the majority of observations were clustered to the east of the WDA and south of Nantucket with highest numbers in the fall months of October-December and one observation in July.

Nantucket Shoals has been observed to be a frequent foraging ground for leatherback sea turtles (Dodge et al, 2018) and is directly adjacent to the WDA. Rider et al. (2024) conducted a satellite telemetry study from 2017 to 2022 to observe behavior of leatherbacks off Massachusetts and North Carolina. Based on movement and feeding behavior, their results suggest that the waters off of Nantucket Shoals provide the most consistent, year-to-year foraging habitat for these turtles. This area also contained the highest concentration of leatherbacks in the study, primarily in late summer and early autumn, where they showed feeding behavior throughout the vertical water column (Rider et al, 2024).

There are limited density estimates for sea turtles in the WDA. As part of the acoustic impact analysis for this project, (Limpert et al. 2024) sea turtle densities in the SouthCoast Wind WDA (plus up to a 50 km buffer) were calculated. More information on the data sources is presented in Section 7.1 of this Opinion. For leatherbacks, seasonal density ranges from 0.034 animal/100km^2 in the winter and spring to 0.873 animals/100km^2 in the fall.

Sasso et al. (2021) presents information on the use of the Gulf of Mexico by leatherbacks. Individuals are present year round with highest abundance during the summer and early autumn as post-nesting turtles enter the Gulf from Caribbean nesting beaches during the summer and move to the Caribbean in the late fall. The summer and early fall period coincides with the period of greatest abundance of the leatherback's preferred jellyfish prey. The northeastern Gulf of Mexico off the Florida Panhandle and the southeastern Gulf of Mexico in the Bay of Campeche off the state of Tabasco, Mexico have been identified as primary foraging areas.

Based on the information presented here, we anticipate leatherback sea turtles to occur in the WDA during the warmer months, typically between June and November, and to be especially active and abundant in the Nantucket Shoals area where foraging is expected. Leatherbacks are also expected along the vessel transit routes, with seasonal presence dependent on latitude, as well as in the Gulf of Mexico (year round).

Northwest Atlantic DPS of Loggerhead sea turtles

The loggerhead is commonly found throughout the North Atlantic including the Gulf of Mexico, the northern Caribbean, the Bahamas archipelago (Dow et al. 2007), and eastward to West Africa, the western Mediterranean, and the west coast of Europe (NMFS and USFWS 2008).

The range of the Northwest Atlantic DPS is the Northwest Atlantic Ocean north of the equator, south of 60° N. Lat., and west of 40° W. Long. Northwest Atlantic DPS loggerheads occur in the oceanic portions of the action area west of 40°W. Northwest Atlantic DPS loggerheads occur in the oceanic portions of the action area west of 40°W, inclusive of the Gulf of Mexico.

Extensive tagging results suggest that tagged loggerheads occur on the continental shelf along the United States Atlantic from Florida to North Carolina year-round but also highlight the importance of summer foraging areas on the Mid-Atlantic shelf, which includes the action area (Winton et al. 2018). In southern New England, loggerhead sea turtles can be found seasonally, primarily in the summer and autumn months when surface temperatures range from 44.6ºF to 86ºF (7ºC to 30ºC) (Kenney and Vigness-Raposa 2010; Shoop and Kenney 1992). Loggerheads are absent from southern New England during winter months (Kenney and Vigness-Raposa 2010; Shoop and Kenney 1992). Aerial surveys conducted over the Massachusetts WEA in 2020-2021, observed loggerhead sea turtles in the eastern portions of the WEA and Nantucket Shoals concentrated in the fall (O'Brien 2021, 2022).

During the CETAP surveys, one of the largest observed aggregations of loggerheads was documented in shallow shelf waters northeast of Long Island (Shoop and Kenney 1992). Loggerheads were most frequently observed in areas ranging from 72 to 160 feet (22 and 49 m) deep. Over 80% of all sightings were in waters less than 262 feet (80 m), suggesting a preference for relatively shallow OCS habitats (Shoop and Kenney 1992).

In the summer of 2010, as part of the AMAPPS project, the NEFSC and SEFSC estimated the abundance of juvenile and adult loggerhead sea turtles in the portion of the northwestern Atlantic continental shelf between Cape Canaveral, Florida and the mouth of the Gulf of St. Lawrence, Canada (NEFSC and SEFSC 2011). The abundance estimates were based on data collected from an aerial line-transect sighting survey as well as satellite tagged loggerheads. The preliminary regional abundance estimate was about 588,000 individuals (approximate inter-quartile range of 382,000- 817,000) based on only the positively identified loggerhead sightings, and about 801,000 individuals (approximate inter-quartile range of 521,000-1,111,000) when based on the positively identified loggerheads and a portion of the unidentified sea turtle sightings (NMFS 2011b). The loggerhead was the most frequently observed sea turtle species in 2010 to 2013 AMAPPS aerial surveys of the Atlantic continental shelf. Large concentrations were regularly observed in proximity to the RI/MA WEA (NEFSC and SEFSC 2018). Kraus et al. (2016) observed loggerhead sea turtles within the RI/MA WEA in the spring, summer, and autumn, with the greatest density of observations in August and September.

Barco et al. (2018) estimated loggerhead sea turtle abundance and density in the southern portion of the Mid-Atlantic Bight and Chesapeake Bay using data from 2011-2012. During aerial surveys off Virginia and Maryland, loggerhead sea turtles were the most common turtle species detected, followed by greens and leatherbacks, with few Kemp's ridleys documented. Density varied both spatially and temporally. Loggerhead abundance and density estimates in the ocean were higher in the spring (May-June) than the summer (July-August) or fall (September-October). Ocean abundance estimates of loggerheads ranged from highs of 27,508-80,503 in the spring months of May-June to lows of 3,005-17,962 in the fall months of September-October (Barco et al. 2018).

AMAPPS data, along with other sources, have been used in recent modelling studies. Winton et al. (2018) modelled the spatial distribution of satellite-tagged loggerhead sea turtles in the Western North Atlantic. The Mid-Atlantic Bight was identified as an important summer foraging area and the results suggest that the area may support a larger proportion of the population, over 50% of the predicted relative density of loggerheads north of Cape Hatteras from June to October (NMFS 2019a, Winton et al. 2018). Using satellite telemetry observations from 271 large juvenile and adult sea turtles collected from 2004 to 2016, the models predicted that overall densities were greatest in the shelf waters of the U.S. Atlantic coast from Florida to North Carolina. Tagged loggerheads primarily occupied the continental shelf from Long Island, New York to Florida, with some moving offshore. Monthly variation in the Mid-Atlantic Bight indicated migration north to the foraging grounds from March to May and migration south from November to December. In late spring and summer, predicted densities were highest in the shelf waters from Maryland to New Jersey. In the cooler months, the predicted densities in the Mid-Atlantic Bight were higher offshore (Winton et al. 2018). South of Cape Hatteras, there was less seasonal variability and predicted densities were high in all months. Many of the individuals tagged in this area remained in the general vicinity of the tagging location. The authors did caution that the model was driven, at least in part, by the weighting scheme chosen, is reflective only of the tagged population, and has biases associated with the non-random tag deployment. Most loggerheads tagged in the Mid-Atlantic Bight were tagged in offshore shelf waters north of Chesapeake Bay in the spring. Thus, loggerheads in the nearshore areas of the Mid-Atlantic Bight may have been under-represented (Winton et al. 2018).

To better understand loggerhead behavior on the Mid-Atlantic foraging grounds, Patel et al. (2016) used a remotely operated vehicle (ROV) to document the feeding habitats (and prey availability), buoyancy control, and water column use of 73 loggerheads recorded from 2008-2014. When the mouth and face were in view, loggerheads spent 13% of the time feeding on non-gelatinous prey and 2% feeding on gelatinous prey. Feeding on gelatinous prey occurred near the surface to depths of 52.5 ft. (16 m). Non-gelatinous prey were consumed on the bottom. Turtles spent approximately 7% of their time on the surface (associated with breathing), 42% in the near surface region, 44% in the water column, 0.4% near bottom, and 6% on bottom. When diving to depth, turtles displayed negative buoyancy, making staying at the bottom easier (Patel et al. 2016).

Patel et al. (2018) evaluated temperature-depth data from 162 satellite tags deployed on loggerhead sea turtles from 2009 to 2017 when the water column is highly stratified (June 1 – October 4). Turtles arrived in the Mid-Atlantic Bight in late May as the Cold Pool formed and departed in early October when the Cold Pool started to dissipate. The Cold Pool is an oceanographic feature that forms annually in late May. During the highly stratified season, tagged turtles were documented throughout the water column from June through September. Fewer bottom dives occurred north of Hudson Canyon early (June) and late (September) in the foraging season (Patel et al. 2018).

There are limited density estimates for sea turtles in the WDA. As part of the acoustic impact analysis for this project, sea turtle densities for the SouthCoast Wind WDA plus up to a 50 km buffer were calculated (see Table 15 in COP Appendix U2; see also Appendix H in Limpert et al. 2024). More information on the data sources is presented in Section 7.1 of this Opinion. For loggerheads, seasonal density ranges from 0.084 animal/100km^2 in the winter and spring to 0.755 animals/100km^2 in the fall.

Based on the information presented here, we anticipate loggerheads from the Northwest Atlantic DPS to occur in the WDA (i.e., the WFA and cable corridors) during the warmer months, typically between June and November, with foraging expected to occur as the area adjacent to Nantucket Shoals provides important foraging habitat (Rider et al. 2024, Dodge et al. 2014). Loggerheads are also expected along the vessel transit routes, with seasonal presence dependent on latitude, as well as in the Gulf of Mexico (year round).

Kemp's ridley sea turtles

Kemp's ridleys are distributed throughout the Gulf of Mexico and U.S. Atlantic coastal waters, from Florida to New England. Adult Kemp's ridleys primarily occupy nearshore coastal (neritic) habitats. Many adult Kemp's ridleys remain in the Gulf of Mexico, with only occasional occurrence in the Atlantic Ocean (NMFS, USFWS, and SEAMARNAT 2011). Adult habitat largely consists of sandy and muddy areas in shallow, nearshore waters less than 120 feet (37 m) deep (Landry and Seney 2008; Shaver et al. 2005; Shaver and Rubio 2008), although they can also be found in deeper offshore waters.

During spring and summer, juvenile Kemp's ridleys generally occur in the shallow coastal waters of the northern Gulf of Mexico from south Texas to north Florida and along the United States Atlantic coast from southern Florida to the Mid-Atlantic and New England. In addition, the NEFSC caught a juvenile Kemp's ridley during a recent research project in deep water south of Georges Bank (NEFSC unpublished data, as cited in NMFS [2020]). In the fall, most Kemp's ridleys migrate to deeper or more southern, warmer waters and remain there through the winter (Schmid 1998). Adult habitat largely consists of sandy and muddy areas in shallow, nearshore waters less than 120 feet (37 m) deep (Seney and Landry 2008; Shaver et al. 2005; Shaver and Rubio 2008), although they can also be found in deeper offshore waters.

Juvenile and subadult Kemp's ridley sea turtles are known to travel as far north as Long Island Sound and Cape Cod Bay during summer and autumn foraging (NMFS, USFWS, and SEAMARNAT 2011). Visual sighting data are limited because this small species is difficult to observe using aerial survey methods (Kraus et al. 2016), and most surveys do not cover its preferred shallow bay and estuary habitats. However, Kraus et al. (2016) recorded six observations in the RI/MA WEA over 4 years, all in August and September 2012. The sighting data were insufficient for calculating SPUE for this species (Kraus et al. 2016). Other aerial surveys efforts conducted in the region between 1998 and 2017 have observational records of species occurrence in the waters surrounding the RI/ME WEA during the autumn (September to November) at densities ranging from 10 to 40 individuals per 1,000 km (North Atlantic Right Whale Consortium 2018; NEFSC and SEFSC 2018). Juvenile Kemp's ridley sea turtles represented 66% of 293 cold-stunned turtle stranding records collected in inshore waters of Long Island Sound from 1981 to 1997 (Gerle et al. 1997) and represent the greatest number of sea turtle strandings in most years.

There are limited density estimates for sea turtles in the WDA. As part of the acoustic impact analysis for this project, sea turtle densities for the SouthCoast Wind WDA plus up to a 50 km buffer were evaluated (see Table 15 in COP Appendix U2 and Appendix H in Limpert et al. 2024). More information on the data sources is presented in Section 7.1 of this Opinion. For Kemp's ridleys, seasonal density is estimated at 0.006 animal/100km^2 year round; however, presence from December – April is extremely unlikely due to low water temperatures in the WDA at that time of year.

Based on the information presented here, we anticipate Kemp's ridley sea turtles to occur in the WDA during the warmer months, typically between June and November. Kemp's ridleys are also expected along the vessel transit routes, with seasonal presence dependent on latitude, as well as in the Gulf of Mexico (year round).

North Atlantic DPS of Green sea turtles
Most green turtles spend the majority of their lives in coastal foraging grounds. These areas include fairly shallow waters in both open coastline and protected bays and lagoons. In addition to coastal foraging areas, oceanic habitats are used by oceanic-stage juveniles, migrating adults, and, on some occasions, by green turtles that reside in the oceanic zone for foraging. Green sea turtles are likely to be present seasonally in the WDA and to occur in portions of the vessel traffic component of the action area. Green sea turtles are present year round in the Gulf of Mexico and nesting occurs at some Gulf of Mexico beaches (NMFS and USFWS 2007).

This species is typically observed in U.S. waters in the Gulf of Mexico or coastal waters south of Virginia (USFWS 2021). Juveniles and subadults are occasionally observed in Atlantic coastal waters as far north as Massachusetts (NMFS and USFWS 1991), including the waters of Long Island Sound and Cape Cod Bay (CETAP 1982). Kenney and Vigness-Raposa (2010) recorded one confirmed sighting within the RI/MA WEA in 2005. The Sea Turtle Stranding and Salvage Network (STSSN) reported one offshore and 20 inshore green sea turtle strandings between 2017 and 2019, and green sea turtles are found each year stranded on Cape Cod beaches (NMFS STSSN 2021; WBWS 2018). Five green turtle sightings were recorded off the Long Island shoreline 10 to 30 miles southwest of the RI/MA WEA in aerial surveys conducted from 2010-2013 (NEFSC and SEFSC 2018). However, given the relative abundance of observations farther to the south, adult green sea turtles are likely an infrequent visitor to the area. This conclusion is supported by the lack of green sea turtle observations recorded in an intensive aerial survey of the RI/MA WEA from October 2011 to June 2015 (Kraus et al. 2016). However, the aerial survey methods used in the region to date are unable to reliably detect juvenile turtles, sight several unidentified turtles, and do not cover the shallow nearshore habitats most commonly used by this species.

Juvenile green sea turtles represented 6% of 293 cold-stunned turtle stranding records collected in inshore waters of Long Island Sound from 1981 to 1997 (Gerle et al. 1997) and represent the lowest number of overall stranding between 1979 and 2016. These and other sources of information indicate that juvenile green turtles occur periodically in shallow nearshore waters of Long Island Sound and the coastal bays of New England (Morreale et al. 1992; Massachusetts Audubon 2012), but their presence offshore in the Lease Area is also possible.

There are limited density estimates for green sea turtles in the WDA. As part of the acoustic impact analysis for this project, sea turtle densities were evaluated for the SouthCoast Wind

WDA plus up to a 50 km buffer. More information on the data sources is presented in Section 7.1 of this Opinion. Green sea turtles are rare in this area and there are no density data available for this species, so the Kemp's ridley sea turtle density is used as a surrogate; this is reasonable based on the known distribution of Green sea turtles in New England waters. As such, seasonal density ranges for green sea turtles are expected to be less than 0.006 animal/100km^2 year-round in the WDA, with no green sea turtles expected in the winter.

Based on the information presented here, we anticipate green sea turtles to occur in the WDA during the warmer months, typically between June and November. Green sea turtles are also expected along the vessel transit routes, with seasonal presence dependent on latitude, as well as in the Gulf of Mexico (year round).

6.3 Summary of Information on Listed Marine Fish in the Action Area

Atlantic sturgeon (Acipenser oxyrinchus oxyrinchus)
Adult and subadult (not sexually mature, but have left their natal rivers; typically less than 150cm in total length,) Atlantic sturgeon from all five DPSs undertake seasonal, nearshore (i.e., typically depths less than 50 meters), coastal marine migrations along the United States eastern coastline including in waters of southern New England (Dunton et al. 2010, Erickson et al. 2011). Given their anticipated distribution in depths primarily 50 m and less, Atlantic sturgeon are not expected to occur in the deep, open-ocean portion of the action area that will be transited by project vessels traveling to/from distant ports. In addition to at least occasional presence in the WDA, Atlantic sturgeon may also occur along the transit routes to Sparrows Point (MD; transiting channels within the Chesapeake Bay)), and the Nexans Cable facility in Charleston, SC. Atlantic sturgeon do not occur in the Gulf of Mexico.

Atlantic sturgeon demonstrate strong spawning habitat fidelity and extensive migratory behavior (Savoy et al. 2017). Adults and subadults migrate extensively along the Atlantic coastal shelf (Erickson et al. 2011; Savoy et al. 2017), and use the coastal nearshore zone to migrate between river systems (ASSRT 2007; Eyler et al. 2004). Erickson et al. (2011) found that adults remain in nearshore and shelf habitats ranging from 6 to 125 feet (2 to 38 m) in depth, preferring shallower waters in the summer and autumn and deeper waters in the winter and spring. Data from capture records, tagging studies, and other research efforts (Dunton et al. 2010; Stein et al. 2004a, 2004b; Zollett 2009) indicate the potential for occurrence in the action area during all months of the year. Individuals from every Atlantic sturgeon DPS have been captured in the Virginian marine ecoregion (Cook and Auster 2007; Wirgin et al. 2015a, 2015b), which extends from Cape Cod, Massachusetts, to Cape Lookout, North Carolina.

Based on tag data, sturgeon migrate to southern waters (e.g. off the coast of North Carolina and Virginia) during the fall, and migrate to more northern waters (e.g. off the coast of New York, southern New England, as far north as the Bay of Fundy) during the spring (Dunton et al. 2010, Erickson et al. 2011, Wippelhauser et al. 2017). In areas with gravel, sand and/or silt bottom habitats and relatively shallow depths (primarily <50 meters), sturgeon may also be foraging during these trips on prey including mollusks, gastropods, amphipods, annelids, decapods, isopods, and fish such as sand lance (Stein et al. 2004b, Dadswell 2006, Dunton et al. 2010, Erickson et al. 2011).

Atlantic sturgeon aggregate in several distinct areas along the Mid-Atlantic coastline; Atlantic sturgeon are most likely to occur in areas adjacent to estuaries and/or coastal features formed by bay mouths and inlets (Stein *et al.* 2004a; Laney *et. al* 2007; Erickson *et al*. 2011; Dunton *et al*. 2010). These aggregation areas are located within the coastal waters off North Carolina; waters between the Chesapeake Bay and Delaware Bay; the southern New Jersey Coast near the mouth of Delaware Bay; and the southwest shores of Long Island (Laney *et. al* 2007; Erickson *et al*. 2011; Dunton *et al*. 2010). These aggregation areas are believed to be where Atlantic sturgeon overwinter and/or forage (Laney *et. al* 2007; Erickson *et al*. 2011; Dunton *et al*. 2010). These waters are not in the action area. Based on five fishery-independent surveys, Dunton *et al*. (2010) identified several "hotspots" for Atlantic sturgeon captures, including an area off Sandy Hook, New Jersey, and off Rockaway, New York. These "hotspots" are aggregation areas that are most often used during the spring, summer, and fall months (Erickson *et al*. 2011; Dunton *et al*. 2010). These aggregation areas are believed to be where Atlantic sturgeon overwinter and/or forage (Laney *et. al* 2007; Erickson *et al*. 2011; Dunton *et al*. 2010). Areas between these sites are used by sturgeon migrating to and from these areas, as well as to spawning grounds found within natal rivers. Adult sturgeon return to their natal river to spawn in the spring. South of Cape Cod, the nearest rivers to the WDA that is known to regularly support Atlantic sturgeon spawning is the Hudson River. Atlantic sturgeon may also at least occasionally spawn in the Connecticut River. The Delaware River also supports a population of spawning Atlantic sturgeon.

Ingram et al. (2019) studied Atlantic sturgeon distribution in the New York Wind Energy Area by monitoring the movements of tagged Atlantic sturgeon from November 2016 through February 2018 on an array of 24 acoustic receivers (see Figure 1 in Ingram et al. 2019 for acoustic receiver locations). While this area is south of the SouthCoast Wind WDA, it is reasonable to expect that distribution and use of the SouthCoast Wind WDA would be similar, given the similar geography and habitat conditions; however, we note that as the SouthCoast WDA is further offshore, sturgeon presence may be more limited than it is in the New York WEA. Total confirmed detections for Atlantic Sturgeon ranged from 1 to 310 detections per individual, with a total of 5,490 valid detections of 181 unique individuals. Detections of 181 unique Atlantic sturgeon were documented with detections being highly seasonal peaking from November through January, with tagged individuals uncommon (less than 2 individuals detected) or absent in July, August, and September. As described in the paper, Atlantic Sturgeon were detected on all transceivers in the array including the most offshore receiver, located 44.3 km offshore (21 total detections of 5 unique fish). Total counts and detections of unique fish were highest at the receivers nearer to shore and appeared to decrease with distance from shore. Counts at each station ranged between 21–909 total detections and 4–59 unique detections of Atlantic sturgeon. Fifty-five individuals were documented in multiple years. The authors reported that the transition from coastal to offshore areas, predictably associated with photoperiod and river temperature, typically occurred in the autumn and winter months. During this time, individual Atlantic sturgeon were actively moving throughout the area. Residence events, defined in the paper as "a minimum of two successive detections of an individual at a single transceiver station over a minimum period of two hours. Residence events are completed by either a detection of the individual on another transceiver station or a period of 12 hours without detection." Residence events were uncommon (only 22 events over the study period) and of short duration (mean of 10 hours) and were generally limited to receivers with depths of less than 30 m. The authors indicate that the movement patterns may be suggestive of foraging but could not draw any conclusions. By assuming the maximum observed rate of movement of 0.86 m/s and maximum straight-line distance of 40.6 km between stations from the transceiver-distance matrix, the minimum transit time for an Atlantic Sturgeon through the NY WEA at its longest point was estimated to be 13.1 hrs. As described by the authors, the absence of Atlantic Sturgeon in the NY WEA during the summer months, particularly from June through September, suggests a putative shift to nearshore habitat and corresponds with periods of known-residence in shallow, coastal waters that are associated with juvenile and sub-adult aggregations as well as adult spawning migrations.

Rothermel et al. 2020 and Secor et al. 2020 report on a study that used a gradient-based array of acoustic telemetry receivers to evaluate the seasonal incidence and movement behavior of Atlantic sturgeon (and striped bass) in the near-shelf region off the coast of Maryland and Delaware, inclusive of the Maryland WEA. The study documented the presence of tagged Atlantic sturgeon (n=352 individuals) from November 2016 - December 2018. Approximately 50% of the Atlantic sturgeon were detected in only one season, while 34% were detected in two seasons, and 14% in three seasons. Individual occurrence was generally transient, with very few individuals present in the area monitored by the receiver array for more than 24 hours. Sturgeon were most likely to be present from early spring to early summer and early fall to early winter, with very few individuals present in late summer and late winter; sturgeon were generally absent from late spring to early fall. The average time of an individual in the detection radius of receivers was approximately 3 hours, with the mean number of unique days detected was 1.6. Individuals moved quickly through the array, with speeds of approximately 0.33 m/s during southern migrations and 0.18 m/s during northern migrations. The authors conclude that the Maryland WEA is used by transient, migratory individuals which may engage in foraging opportunistically. These findings are similar to those of Ingram et al. 2019 for the NY WEA and support a conclusion that use of offshore areas that are not documented aggregation areas, such as the SouthCoast WDA, by Atlantic sturgeon are most likely to be limited to transient, migratory individuals.

Surveys specifically targeting Atlantic sturgeon have not been carried out in the WDA; however, a number of surveys occur regularly in the action area, including the WDA, that are designed to characterize the fish community and use sampling gear that is expected to collect Atlantic sturgeon if they were present in the area. One such survey is the Northeast Area Monitoring and Assessment Program (NEAMAP), which samples from Cape Cod, MA south to Cape Hatteras, NC and targets both juvenile and adult fishes. The NEAMAP trawl survey samples near shore water to a depth of 60 feet and includes the sounds to 120 feet; the survey area is inshore of the SouthCoast WDA. Atlantic sturgeon are regularly captured in this survey, including the portions of the action area that overlap with the survey area. The action area is also sampled in the NEFSC bottom trawl surveys, which surveys from Cape Hatteras to the Western Scotian Shelf; few Atlantic sturgeon have been collected in the NEFSC bottom trawl survey near or in the WDA.

Between March 2009 and February 2012, 173 Atlantic sturgeon were documented as bycatch in Federal fisheries by the Northeast Observer Program. Observers operated on fishing vessels from the Gulf of Maine to Cape Hatteras. Observer Program coverage across this entire area for this period was 8% of all trips with the exception that Observer coverage for the New England ground fish fisheries, extending from Maine to Rhode Island, was an additional 18% (26% coverage in total). Despite the highest observer coverage in the ground fish fisheries that overlap with the action area and the regular occurrence of commercial fishing activity in the area, only 2 of the 173 Atlantic sturgeon observed by the observer program in this period were collected in the MA/RI portion of the action area.

Dunton et al. (2015) documented sturgeon bycatch in waters less than 50 feet deep during the New York summer flounder fishery; Atlantic sturgeon occurred along eastern Long Island in all seasons except for the winter, with the highest frequency in the spring and fall. The species migrates along coastal New York from April to June and from October to November (Dunton et al. 2015).

Migratory adults and sub-adults have been collected in shallow nearshore areas of the continental shelf (32.9–164 feet [10–50 m]) on any variety of bottom types (silt, sand, gravel, or clay). Evidence suggests that Atlantic sturgeon orient to specific coastal features that provide foraging opportunities linked to depth-specific concentrations of fauna. Concentration areas of Atlantic sturgeon near Chesapeake Bay and North Carolina were strongly correlated with the coastal features formed by the bay mouth, inlets, and the physical and biological features produced by outflow plumes (Kingsford and Suthers 1994, as cited in Stein et al. 2004a). They are also known to commonly aggregate in areas that presumably provide optimal foraging opportunities, such as the Bay of Fundy, Massachusetts Bay, Rhode Island, New Jersey, and Delaware Bay (Dovel and Berggren 1983; Johnson et al. 1997; Rochard et al. 1997; Kynard et al. 2000; Eyler et al. 2004; Stein et al. 2004a; Dadswell 2006, as cited in ASSRT 2007).

Stein et al. (2004a, 2004b) reviewed 21 years of sturgeon bycatch records in the Mid-Atlantic OCS to identify regional patterns of habitat use and association with specific habitat types. Atlantic sturgeon were routinely captured in waters within and in immediate proximity to the action area, most commonly in waters ranging from 33 to 164 feet (10–50 m) deep. Sturgeon in this area were most frequently associated with coarse gravel substrates within a narrow depth range, presumably associated with depth-specific concentrations of preferred prey fauna.

None of the scientific literature that has examined the distribution of Atlantic sturgeon in the marine environment has identified the WDA as a “hot spot” or an identified aggregation area (see above). Based on the location of spawning rivers both north and south of the WDA and the general distribution of Atlantic sturgeon in the marine environment, individual Atlantic sturgeon are expected to be moving through the WDA during the warmer months of the area and may be foraging opportunistically in areas where benthic invertebrates are present; however, the area is not known to be a preferred foraging area. Individual Atlantic sturgeon may be present in the WDA year-round. In the lease area and along the cable corridor (i.e., the WDA), the majority of individuals will be from the New York Bight DPSs.

Summary of Atlantic sturgeon distribution in the action area

In summary, Atlantic sturgeon occur in most of the action area; with the exception being waters transited by project vessels with depths greater than 50m. This means that Atlantic sturgeon will only be present in the nearshore (less than 50 m depth) portion of the vessel transit routes and will not be present in the open ocean areas transited by vessels moving between the WDA and identified ports. In the portion of the action area including the WFA and along the cable corridors, the majority of individuals will be from the New York Bight DPS. Considering the action area as a whole, individuals from all 5 DPSs may be present.

6.4 Consideration of Federal, State, and Private Activities in the Action Area

Activities in the Coastal and Riverine Portions of the Action Area
In addition to fishing activity and vessel traffic, portions of these areas have navigation channels that are maintained by dredging, and are affected by routine in-water construction activities such as dock, pier, and wharf maintenance and construction.

Loggerhead, Kemp's ridley, and green sea turtles and Atlantic are vulnerable to serious injury and mortality in hopper dredges that are used to maintain federal navigation channels in the action area, including channels in Chesapeake Bay, and the Delaware River/Bay. NMFS has completed ESA Section 7 consultations on these actions; measures are in place to avoid and minimize take and in all cases, NMFS has determined that the proposed actions are not likely to jeopardize the continued existence of any listed species[26]. We expect that mortality of sturgeon and sea turtles as a result of maintenance dredging and channel deepening will continue in the action area over the life of the SouthCoast Wind Farm project.

Fishing Activity in the Action Area
Commercial and recreational fishing occurs throughout the action area. The SouthCoast Wind lease is a small portion (<1%) of NMFS statistical area 537 and the cable route extends through 537 to area 538 and 539. Transit routes to identified ports overlap with a number of other statistical areas (see, https://www.fisheries.noaa.gov/resource/map/greater-atlantic-region-statistical-areas). Commercial fishing in the action area is authorized by the individual states or by NMFS under the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA). Fisheries that operate pursuant to the MSFCMA have undergone consultation pursuant to Section 7 of the ESA. These biological opinions are available online (available at: https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-biological-opinions-greater-atlantic-region). The accompanying Incidental Take Statements, which describe the amount or extent of incidental take anticipated to occur in these fisheries, are included with each opinion.

Given that fisheries occurring in the action area are known to interact with large whales, the past and ongoing risk of capture and entanglement in the action area is considered here. The degree of risk in the future may change in association with fishing practices and accompanying regulations.

[26] Relevant biological opinions are available on our webpage: https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-biological-opinions-greater-atlantic-region. This includes consultations completed by NMFS GARFO in 2019 for the maintenance of the Delaware River Federal Navigation Channel and in 2018 for the construction and maintenance of the Chesapeake Bay Entrance Channels. These Opinions include Incidental Take Statements that exempt an identified amount of take of Atlantic sturgeon and Kemp's ridley, green, and loggerhead sea turtles.

It is important to note that in nearly all cases, the location where a whale first encountered entangling gear is unknown and the location reported is the location where the entangled whale was first sighted. The risk of entanglement in fishing gear to blue, fin, sei, and sperm whales in the lease area appears to be low given the low interaction rates in the U.S. EEZ as a whole.

We have reviewed the most recent data available on reported entanglements for the ESA listed whale stocks that occur in the action area (Hayes et al. 2023, 2022, 2021, and 2020 and Henry et al. 2022 and 2023). As reported in Hayes et al. 2022, for the most recent 5-year period of review (2015-2019) in the U.S. Atlantic, the minimum rate of serious injury or mortality resulting from fishery interactions was 1.45/year for fin whales and 0.4 for sei whales. For the period 2016-2020, the annual detected (observed) human-caused mortality and serious injury for right whales averaged 5.7 entanglements per year (Hayes et al. 2023). The minimum rate of serious injury or mortality resulting from fishery interaction is zero for blue and sperm whales as reported in the most recent SAR for blue whales and sperm whales in the North Atlantic (Hayes et al. 2020). For the Gulf of Mexico, Hayes et al. (2021) reports the estimated mean annual fishery-related mortality and serious injury for sperm whales during 2014–2018 was 0.2 sperm whales (CV=1.00) due to interactions with the large pelagic longline fishery. In all cases, the authors note that this is a minimum estimate of the amount of entanglement and resultant serious injury or mortality. These data represent only known mortalities and serious injuries; more, undocumented mortalities and serious injuries have likely occurred and gone undetected due to the offshore habitats where large whales occur. Hayes et al. (2020) notes that no confirmed fishery-related mortalities or serious injuries of sei whales have been reported in the NMFS Sea Sampling bycatch database and that a review of the records of stranded, floating, or injured sei whales for the period 2015 through 2019 on file at NMFS found 3 records with substantial evidence of fishery interaction causing serious injury or mortality. Hayes et al. (2020), reports that sperm whales have not been documented as bycatch in the observed U.S. Atlantic commercial fisheries. No confirmed fishery-related mortalities or serious injuries of fin whales have been reported in the NMFS Sea Sampling bycatch database and a review of the records of stranded, floating, or injured fin whales for the period 2015 through 2019 with substantial evidence of fishery interactions causing injury or mortality are captured in the total observed incidental fishery interaction rate reported above (Hayes et al. 2022).

We also reviewed available data that post-dates the information presented in the most recent stock assessment reports. As explained in Section 5.0 *Status of the Species* of this Opinion, there is an active UME for North Atlantic right whales[27]. Of the 142 right whales in the UME (as of August 9, 2024), 9 mortalities are attributed to entanglement as well as 32 serious injuries and 49 sublethal injuries. None of the whales recorded as part of the UME were first documented in the WDA[28]. We reviewed information on serious injury and mortalities reported in Henry et al. 2022. Six live right whales were first documented as entangled in waters off the coast of southern Massachusetts; right whale 3139 was documented showing entanglement related injuries (without gear currently present) on July 4, 2017 approximately 1.5 nm south of Nantucket, MA. Right whale 4091 was documented as free-swimming with a line trailing from it

[27] Information in this paragraph related to the UME is available at: https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2024-north-atlantic-right-whale-unusual-mortality-event; last accessed on August 9, 2024

[28] https://noaa.maps.arcgis.com/apps/webappviewer/index.html?id=e502f7daf4af43ffa9776c17c2aff3ea; last accessed August 9, 2024

on May 12, 2018 approximately 53.7 nm east of Chatham, MA. North Atlantic right whale 3208 was observed injured without gear present on December 1, 2018, 30.8 nm south of Nantucket, MA. On December 20, 2018, right whale 2310 was observed swimming with gear through the mouth 238.5 nm southeast of Nantucket, MA, and on December 27, 2018. Right whale 3950 was observed with new, healed injuries without gear present and was located 16.3 nm south of Nantucket, MA. North Atlantic right whale 3466 was seen swimming 20.03 nm south of Nantucket, MA on December 21, 2019. It was free-swimming, but multiple lines were seen around the mouth and trailed behind the whale for approximately 1 body length, and subsequent sightings indicated the gear was shed successfully with evidence of healing injuries. It is unknown where these entanglements actually occurred. Henry et al. 2022 includes no records of entangled fin, sei, blue, or sperm whales first reported in waters between Long Island, NY to Nantucket Shoals. Henry et al. 2022 presented three documented human-caused mortality events for North Atlantic right whales in the coastal area between Long Island, NY and Martha's Vineyard, MA since 2016. The first was the right whale 4681 located near Morris Island, MA (southeast of Cape Cod) on May 3, 2016 due to sharp trauma. The following two were unknown whales on August 6, 2017 and August 25, 2018 and both were near Martha's Vineyard, MA. The whale found on August 6, 2017 had no gear present, but showed signs of constriction associated with gear and evidence of subsequent hemorrhaging. Similarly, the whale found on August 25, 2018 had no gear present, but showed evidence of acute entanglement surrounding the pectoral area as well as hemorrhaging.

Given the co-occurrence of fisheries and large whales in the action area, it is assumed that there have been entanglements in the action area in the past and that this risk will persist at some level throughout the life of the project. However, it is important to note that several significant actions have been taken to reduce the risk of entanglement in fisheries that operate in the action area including ongoing implementation of the Atlantic Large Whale Take Reduction Plan. The goal of the ALWTRP is to reduce injuries and deaths of large whales due to incidental entanglement in fishing gear. The ALWTRP is an evolving plan that changes as NMFS learns more about why whales become entangled and how fishing practices might be modified to reduce the risk of entanglement. It has several components including restrictions on where and how gear can be set; research into whale populations and whale behavior, as well as fishing gear interactions and modifications; outreach to inform and collaborate with fishermen and other stakeholders; and a large whale disentanglement program that seeks to safely remove entangling gear from large whales whenever possible. All states that regulate fisheries in the U.S. portion of the action area codify the ALWTRP measures into their state fishery regulations. Additional information, including rulemaking and links to analyses carried out under the NEPA is available on the ALWTRP webpage (https://www.fisheries.noaa.gov/new-england-mid-atlantic/marine-mammal-protection/atlantic-large-whale-take-reduction-plan).

Atlantic sturgeon are captured as bycatch in trawl and gillnet fisheries. An analysis of the NEFOP/ASM bycatch data from 2000-2015 (ASMFC 2017) found that most trips that encountered Atlantic sturgeon were in depths less than 20 meters and water temperatures between 45-60°F. Average mortality in bottom otter trawls was 4% and mortality averaged 30% in gillnets (ASMFC 2017). The most recent five years of data in the NMFS NEFOP and ASM database (2018-2022) were queried for the number of reports of Atlantic sturgeon bycatch in the statistical areas that overlap with the lease area and cable routes (537, 538 and 539[23]). The

NEFOP program samples a percentage of trips from the Gulf of Maine to Cape Hatteras while the ASM program provides additive coverage for the New England ground fish fisheries, extending from Maine to New York. For the most recent five- year period that data are available (2018-2022), a total of 60 Atlantic sturgeon were reported as bycatch in bottom otter trawls and gillnets in these two statistical areas, this represents less than 5% of the total observed bycatch of Atlantic sturgeon in the Maine to Cape Hatteras area where the NEFOP, and Maine to New York area where the ASM program, operates. Note that the WDA occupies only a portion of area 537, with the cable routes extending into area 538 and 539. Incidental capture of Atlantic sturgeon is expected to continue in the action area at a similar rate over the life of the proposed action. While the rate of encounter is low and survival is relatively high (96% in commercial otter trawls and 70% in commercial gillnets), bycatch is expected to be a primary source of mortality of Atlantic sturgeon in the action area.

Sea turtles are vulnerable to capture in trawls as well as entanglement in gillnets and vertical lines. Using the same data source as for Atlantic sturgeon, there were a total of 15 incidents of observed sea turtle bycatch in gillnet, trap/pot, and bottom otter trawl fisheries in areas 537 and 539 (1 green, 2 Kemp's ridley, 2 leatherback, 8 loggerhead and 2 unknown). Leatherback sea turtles are particularly vulnerable to entanglement in vertical lines. Since 2005, over 230 leatherbacks have been reported entangled in vertical lines in Massachusetts alone. In response to high numbers of leatherback sea turtles found entangled in the vertical lines of fixed gear in the Northeast Region, NMFS established the Northeast Atlantic Coast Sea Turtle Disentanglement Network (STDN). Formally established in 2002, the STDN is an important component of the National Sea Turtle Stranding and Salvage Network. The STDN works to reduce serious injuries and mortalities caused by entanglements and is active throughout the action area responding to reports of entanglements. Where possible, turtles are disentangled and may be brought back to rehabilitation facilities for treatment and recovery. This helps to reduce the rate of death from entanglement. The Southeast STDN provides similar services in the South Atlantic and Gulf of Mexico. Sea turtles are also captured in fisheries operating in the Gulf of Mexico and in offshore areas where pelagic fisheries such as the Atlantic Highly Migratory Species (HMS) fishery occurs. Sea turtles are also vulnerable to interactions with fisheries occurring off the U.S. South Atlantic coast including the Atlantic shrimp trawl fishery. For all fisheries for which there is a fishery management plan (FMP) or for which any federal action is taken to manage that fishery, the impacts have been evaluated via Section 7 consultation. Past consultations have addressed the effects of federally permitted fisheries on ESA-listed species, sought to minimize the adverse impacts of the action on ESA-listed species, and, when appropriate, have authorized the incidental taking of these species. These biological opinions, including for Southeast U.S. Shrimp Fisheries in Federal Waters (2020) and Coastal Migratory Pelagic Resources in the Atlantic and Gulf of Mexico (2015) are available online (available at: https://www.fisheries.noaa.gov/endangered-species-conservation/endangered-species-act-section-7-biological-opinions-southeast). The accompanying Incidental Take Statements, which describe the amount or extent of incidental take anticipated to occur in these fisheries, are included with each opinion. Incidental capture and entanglement of sea turtles is expected to continue in the action area at a similar rate over the life of the proposed action. Safe release and disentanglement protocols help to reduce the severity of impacts of these interactions and these efforts are expected to continue over the life of the project.

Vessel Operations
The action area is used by a variety of vessels ranging from small recreational fishing vessels to large commercial cargo ships. Commercial vessel traffic in the action area includes research, tug/barge, liquid tankers, cargo, military and search-and-rescue vessels, and commercial fishing vessels.

Vessel Traffic between the Lease Area and Ports to the South
Vessel traffic along the southern U.S. coast mainly consists of tug and barge, fishing vessels, tankers, container ships, and passenger vessels; military vessels also transit the area conducting training and operations. Vessels typically travel offshore before entering a traffic separation scheme heading into port. Traffic generally travels in a north to south or south to north direction. Throughout the Mid-Atlantic, commercial vessel traffic is significant throughout the year with a number of major U.S. ports located along the coast. These ports include ones in the Sparrows Point, MD and Charleston, SC. Vessel traffic is heaviest in the nearshore waters, near major ports, in the shipping lanes. Recreational vessel traffic is high throughout these areas but is generally close to shore compared to commercial vessel travel.

The Gulf of Mexico is known for a high level of commercial shipping activity and many large ports, especially those with transiting bulk carriers (Wiggins et al. 2016). AIS data for the Gulf of Mexico shows a variety of vessel traffic for the region ranging from cargo, fishing, passenger, pleasure, tankers, and tug-tows. Ports located within the Gulf of Mexico support large amounts of shipping traffic (e.g., the port at Corpus Christi, TX has annual tonnage of 85,674,968).[29] Gulf of Mexico vessel traffic is routed with shipping fairways, traffic separations schemes, and traffic lanes.

Vessel Traffic in the Lease Area and Surrounding Waters
In Appendix X of the COP (Navigation Safety Risk Assessment, DNV-GL 2021), SouthCoast Wind reports on vessel traffic in the WDA and surrounding waters based on AIS data. Based on this data, the most common type of vessels transiting in the WDA are fishing and pleasure craft\sailing vessels, which are most dense in the northeastern portion of the WDA.

The marine component of the action area supports considerable vessel traffic, ranging from thousands of large and small vessel trips per year near coastal areas and in and around major shipping lanes to dozens of vessel trips in some low-traffic areas in the SouthCoast Wind WFA (DNV-GL 2021). DNV-GL (2021) summarized vessel traffic in the vicinity of the proposed action based on AIS data from data for 2019; 2016 vessel monitoring system data from NMFS; vessel trip report data from 2011 to 2015; the Massachusetts and Rhode Island Port Access Route Study (USCG 2020); and interactions with recreational boating, fishing, and towing industry organizations, agencies, and other stakeholders. The number of vessel tracks in the study area is highest in the summer with a peak in July of over 21,000 tracks. The low is in January with less than 3,500 tracks (DNV-GL 2021). The data include eight vessel classes: cargo, fishing, passenger, pleasure craft, tanker, tanker – oil, tug/tow and other/undefined. The average cargo/carrier vessel is 823 feet (251 meters) LOA. Oil tankers and other tankers average 633 feet (193 meters) and 564 feet (172 meters) LOA, respectively. Fishing, pleasure and tugs

[29] marinecadastre.gov (last accessed August 20, 2024).

all average less than 82 feet (25 meters) LOA. Beam and DWT show similar patterns. The majority of the vessels in the WDA were either fishing or recreational, though cargo, tanker, passenger, tug-tow, military, and other vessels were also recorded. Approximately 69.5% of vessel traffic in the lease area was attributed to fishing vessels. The levels of vessel traffic observed by DNV-GL for 2019 is broadly consistent with the findings of the U.S. Coast Guard (USCG 2020) analysis of vessel traffic patterns in the same area for the period from 2015 through 2018. However, as described below, the levels of vessel traffic in the general vicinity increased significantly from 2015 to 2018 (USCG 2020).

Table 6.2. Vessel Types within the Project Area (larger than the WDA) during 2019 (BA Table 4.7-1).

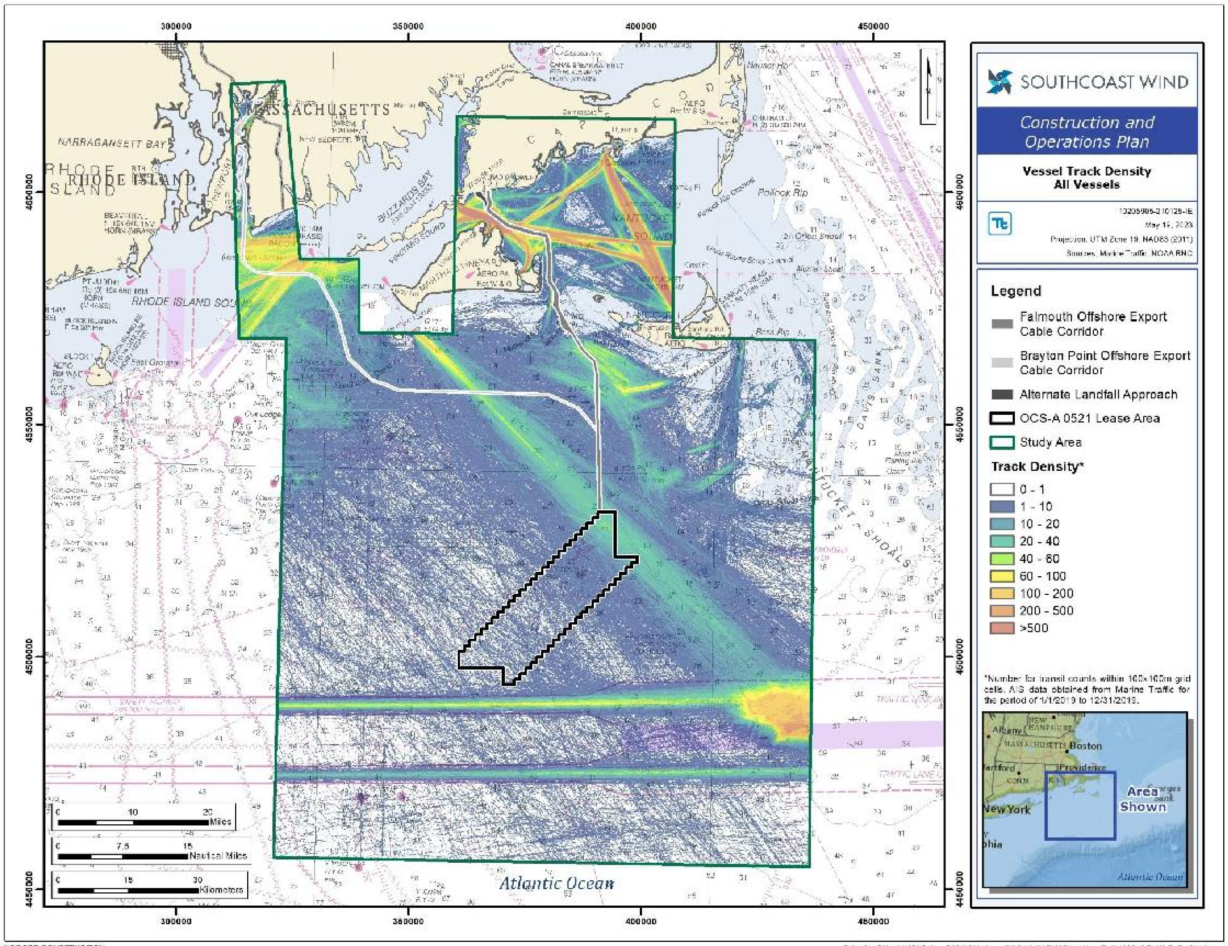
	Unique Vessels	
Vessel Type	**Number**	**Percentage**
Cargo Vessel	163	1%
Tankers	180	1%
Passenger Vessels	2,803	9%
Tug/Tow Vessels	1,708	6%
Fishing Vessels	11,303	38%
Pleasure Craft/Sailing	11,251	38%
Other/Not Available	2,326	8%
Total	**29,734**	**100%**

Traffic along or crossing the Export Cable Corridor (ECC) which connects the lease area to the coastline of Massachusetts was also analyzed. In the northern portion of the Brayton Point ECC, Mount Hope Bay and the Sakonnet River, shallow draft vessels comprise most of the vessel traffic, primarily passenger and pleasure types. Cargo and tanker densities are very low, averaging a few port calls per month or fewer. Most of the vessel crossing traffic occurs between Martha's Vineyard and the mainland of Cape Cod. Overall, vessel traffic density along the ECC is relatively low, with the highest concentration of traffic midway through Nantucket Sound. See Appendix X of the COP for a detailed description of vessel traffic patterns and statistics.

General vessel traffic in the area surrounding the lease area varies, ranging from thousands of large and small vessel trips in and around major shipping lanes to dozens of vessel trips in the low-traffic areas in the WFA (DNV-GL 2021). DNV-GL (2021) analyzed vessel traffic patterns in the WDA to assess navigation safety risks using a two-step analysis. The first step relied on quantification of vessel transits through designated cross sections in proximity to the action area using AIS data for all vessel classes. The second step relied on Vessel Monitoring System (VMS) data for fishing vessels. The VMS system provides location data used by NMFS to monitor fishing activity while maintaining confidentiality.

Figure 6.1 below (from the COP Figure 13-2) displays AIS vessel tracks in proximity to the proposed project footprint, regional traffic corridors, and port entrances.

Figure 6.1. AIS Traffic Density in the NSRA Study Area (COP Figure 13-2)



The USCG (2020) vessel traffic analysis also summarized vessel traffic by class in the RI/MA WEA and surroundings. USCG data indicate a substantial increase in vessel traffic in the defined study area[30] from 2015 through 2018

To comply with the Ship Strike Reduction Rule (50 CFR 224.105), all vessels greater than or equal to 65 ft. (19.8 m) in overall length and subject to the jurisdiction of the United States and all vessels greater than or equal to 65 ft. in overall length entering or departing a port or place subject to the jurisdiction of the United States must slow to speeds of 10 knots or less in seasonal management areas (SMA). The Block Island SMA, overlaps with the portion of the action area where the project will be constructed. All vessels 65 feet or longer that transit the SMA from November 1 – April 30 each year (the period when right whale abundance is greatest) must operate at 10 knots or less. Mandatory speed restrictions of 10 knots or less are required in all of

[30] The MARIPARS study area is bounded by a rectangular area defined by the following corner coordinates: (1) 41°20′ N, 070°00′ W; (2) 40°35′ N, 070°00′ W; (3) 40°35′ N, 071°15′ W; (4) 41°20′ N, 071°15′ W.

the SMAs along the U.S. East Coast during times when right whales are likely to be present; a number of these SMAs overlap with the portion of the action area that may be used by project vessels. The purpose of this regulation is to reduce the likelihood of deaths and serious injuries to these endangered whales that result from collisions with ships. On August 1, 2022, NMFS published proposed amendments to the North Atlantic vessel strike reduction rule (87 FR 46921). The proposed rule would: (1) modify the spatial and temporal boundaries of current speed restriction areas referred to as Seasonal Management Areas (SMAs), (2) include most vessels greater than or equal to 35 ft. (10.7 m) and less than 65 ft. (19.8 m) in length in the size class subject to speed restriction, (3) create a Dynamic Speed Zone framework to implement mandatory speed restrictions when whales are known to be present outside active SMAs, and (4) update the speed rule's safety deviation provision. Changes to the speed regulations are proposed to reduce vessel strike risk based on a coast-wide collision mortality risk assessment and updated information on right whale distribution, vessel traffic patterns, and vessel strike mortality and serious injury events. To date, the rule has not been finalized and its potential effects have not been included in the baseline.

Restrictions are in place on how close vessels can approach right whales to reduce vessel-related impacts, including disturbance. NMFS rulemaking (62 FR 6729, February 13, 1997) restricts vessel approach to right whales to a distance of 500 yards. This rule is expected to reduce the potential for vessel collisions and other adverse vessel-related effects in the environmental baseline. The Mandatory Ship Reporting System (MSR) requires ships entering the northeast and southeast MSR boundaries to report the vessel identity, date, time, course, speed, destination, and other relevant information. In return, the vessel receives an automated reply with the most recent right whale sightings or management areas and information on precautionary measures to take while in the vicinity of right whales.

SMAs are supplemented by Dynamic Management Areas (DMAs) that are implemented for 15-day periods in areas in which right whales are sighted outside of SMA boundaries (73 FR 60173; October 10, 2008). DMAs can be designated anywhere along the U.S. eastern seaboard, including the action area, when NOAA aerial surveys or other reliable sources report aggregations of three or more right whales in a density that indicates the whales are likely to persist in the area. DMAs are put in place for two weeks in an area that encompass an area commensurate to the number of whales present. Mariners are notified of DMAs via email, the internet, Broadcast Notice to Mariners (BNM), NOAA Weather Radio, and the Mandatory Ship Reporting system (MSR). NOAA requests that mariners navigate around these zones or transit through them at 10 knots or less. In 2021, NMFS supplemented the DMA program with a new Slow Zone program, which identifies areas for recommended 10-knot speed reductions based on acoustic detection of right whales. Together, these zones are established around areas where right whales have been recently seen or heard, and the program provides maps and coordinates to vessel operators indicating areas where they have been detected. Compliance with these zones is voluntary.

Atlantic sturgeon, sea turtles, and ESA listed whales are all vulnerable to vessel strike, although the risk factors and areas of concern are different. Vessels have the potential to affect animals through strikes, sound, and disturbance by their physical presence.

As reported in Hayes et al. 2022, for the most recent 5-year period of review (2015-2019) in the North Atlantic, the minimum rate of serious injury or mortality resulting from vessel interactions is 0.40/year for fin whales, and 0.2 for sei whales. As reported in Hayes et al. 2023, for the most recent 5-year period of review (2016-2020) in the North Atlantic, the minimum rate of serious injury or mortality resulting from vessel interactions is 2.4/year for right whales. No vessel strikes for blue or sperm whales have been documented (Hayes et al. 2020). A review of available data on serious injury and mortality determinations for blue, sei, fin, and sperm whales for 2000-2021 and right whales for 2000- September 2024 (Henry et al. 2023, 2022, UME website as cited above), includes no records of whales that were first detected in the WDA. The nearest records identified in the UME are four right whales documented in 2017, 2018 and 2024 in moderate to advanced decomposition off the southern coast of Martha's Vineyard[31]. Hayes et al. (2021) reports three vessel struck sei whales first documented in the U.S. Northeast – all three were discovered on the bow of vessels entering port (two in the Hudson River and one in the Delaware River); no information on where the whales were hit is available. Hayes et al. (2020) reports only four recorded ship strikes of sperm whales. In May 1994, a ship-struck sperm whale was observed south of Nova Scotia (Reeves and Whitehead 1997), in May 2000, a merchant ship reported a strike in Block Canyon and in 2001, and the U.S. Navy reported a ship strike within the EEZ (NMFS, unpublished data). In 2006, a sperm whale was found dead from ship-strike wounds off Portland, Maine. A similar rate of strike is expected to continue in the action area over the life of the project and we expect vessel strike will continue to be a source of mortality for right, sei, fin, and sperm whales in the action area. As outlined above, there are a number of measures that are in place to reduce the risk of vessel strikes to large whales that apply to vessels that operate in the action area.

NMFS' Sea Turtle Stranding and Salvage Network (STSSN) database provides information on records of stranded sea turtles in the region. The STSSN database was queried for records of stranded sea turtles with evidence of vessel strike throughout the waters of Rhode Island and Massachusetts, south and east of Cape Cod to overlap with the area where the majority of project vessel traffic will occur. Out of the 59 recovered stranded sea turtles in the southern New England region during the most recent three year period (2020-2022) for which data was available, there were 33 recorded sea turtle vessel strikes, primarily between the months of August and November. The majority of strikes were of leatherbacks with a smaller number of loggerhead and green; there was one record of Kemp's ridleys struck in the area for which data was obtained. Due to the greater abundance of sea turtles in southern portions of the action area, particularly along the Florida coast and in the Gulf of Mexico, vessel strike occurs more frequently in this portion of the action area. Foley et al. (2019) reports that based on stranding numbers, being struck by a vessel causes up to about 30% of the mortality of loggerheads, green turtles, and leatherbacks; and up to about 25% of the mortality of Kemp's ridleys in the nearshore areas of Florida. The authors estimate that overall, strikes by motorized watercraft killed a mean of 1,326–4,334 sea turtles each year in Florida during 2000–2014. A similar rate of strike is expected to continue in the action area over the life of the project and we expect that vessel strike will continue to be a source of mortality for sea turtles in the action area.

[31] https://noaa.maps.arcgis.com/apps/webappviewer/index.html?id=e502f7daf4af43ffa9776c17c2aff3ea; last accessed 08/15/24

Atlantic sturgeon are struck and killed by vessels in at least some portions of their range. There are no records of vessel strike in the Atlantic Ocean, with all records within rivers and estuaries. Risk is thought to be highest in areas with geographies that increase the likelihood of co-occurrence between Atlantic sturgeon and vessels operating at a high rate of speed or with propellers large enough to entrain sturgeon. NMFS has only minimum counts of the number of Atlantic sturgeon that are struck and killed by vessels because only sturgeon that are found dead with evidence of a vessel strike are counted. New research, including a study that intentionally placed Atlantic sturgeon carcasses along the Delaware River in areas used by the public, suggests that most Atlantic sturgeon carcasses are not found and, when found, many are not reported to NMFS or to our sturgeon salvage co-investigators (Balazik et al. 2012b, Balazik, pers. comm. in ASMFC 2017; Fox et al. 2020).

Offshore Wind Development

The action area includes a number of areas that have been leased by BOEM for offshore wind development or that are being considered for lease issuance. As noted above, in Section 6.0 *Environmental Baseline* of an Opinion, we consider the past and present impacts of all federal, state, or private activities and other human activities in the action area, the anticipated impacts of all proposed federal actions that have already undergone formal or early Section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. In the context of offshore wind development, past and present impacts in the action area include the effects of pre-construction surveys to support site characterization, site assessment, and data collection to support the development of Construction and Operations Plans (COPs), the construction of the South Fork Project as well as ongoing effects of construction of the Revolution Wind and Vineyard Wind 1 projects.

To date, we have completed Section 7 consultation to consider the effects of construction, operation, and decommissioning of multiple commercial scale offshore wind projects along the U.S. Atlantic coast (Vineyard Wind 1, South Fork Wind, Ocean Wind 1, Revolution Wind, Sunrise Wind, CVOW, Empire Wind, Atlantic Shores South, New England Wind, and Maryland Wind). At this time, construction of the South Fork Wind project has been completed and construction of the COVW, Revolution Wind, and Vineyard Wind 1 projects are ongoing; these projects are located outside the SouthCoast Wind WFA but within the action area. We have also completed ESA Section 7 consultation on two smaller scale offshore wind projects the Block Island project and Dominion's Coastal Virginia Offshore Wind Demonstration Project consists of two operational WTGs off the coast of Virginia; these projects are within the overall action area and are in the operations and maintenance phase. The past and present effects of approved projects with completed and ongoing construction are included in the environmental baseline; and the anticipated effects of all projects for which formal Section 7 consultation has been completed are included in the environmental baseline. There are no offshore wind projects or associated activities (i.e. site characterization, site assessment) in the action area for which "early consultation" has been initiated or completed pursuant to 50 CFR §402.11.

The offshore wind projects that we have completed formal Section 7 consultation on that are within the action area defined in Section 3.9 of this Opinion are CVOW – Experimental, CVOW – Commercial, Block Island, Empire Wind, Vineyard Wind 1, South Fork Wind, Ocean Wind 1 (noting that status of the lease for this project has been suspended and its development is uncertain), Revolution Wind, Sunrise Wind, Atlantic Shores South, Maryland Wind, and New England Wind. Vessels transiting between the SouthCoast Wind WDA and ports in Massachusetts would travel past the New England Wind, Vineyard Wind, Sunrise Wind, and Revolution Wind Lease Areas. Vessels transiting between the SouthCoast Wind WDA and ports in Sparrows Point MD, Charleston SC, and ports in the Gulf of Mexico would travel past the previously mentioned ports along with Empire Wind, Atlantic Shores South, Ocean Wind 1, Maryland Wind, CVOW Commercial, CVOW Demonstration, and Block Island.

Site Assessment, Site Characterization, and Surveys
A number of geotechnical and geophysical surveys to support wind farm siting have occurred and will continue to occur in the action area including areas to the north and south of the WDA. Additionally, some data collection buoys have been installed. Effects of these activities on ESA listed species in the action area are related to potential exposure to noise associated with survey equipment, survey vessels, and habitat impacts. NMFS GARFO completed a programmatic informal consultation with BOEM in June 2021 that considered the effects of geotechnical and geophysical surveys and buoy deployments (NMFS GAR 2021, Appendix C to this Opinion). The consultation includes a number of best management practices and project design criteria designed to minimize the potential effects of these activities on ESA listed species. In the consultation, we concluded that these activities are not likely to adversely affect any ESA listed species if implemented in accordance with applicable BMPs and PDCs. Given the characteristics of the noise associated with survey equipment and the use of best management practices to limit exposure of listed species, including protected species observers, effects of survey noise on listed species have been determined to be extremely unlikely or insignificant. There is no information that indicates that the noise sources used for these surveys has the potential to result in injury, including hearing impairment, or mortality of any ESA listed species in the action area. Similarly, we have not anticipated any adverse effects to habitats or prey, harassment due to behavioral disturbance, and do not anticipate any ESA listed species to be struck by survey vessels; risk is reduced by the slow speeds that survey vessels operate at, the use of lookouts, and incorporation of vessel strike avoidance measures.

Surveys to obtain data on fisheries resources have been undertaken in the action area to support OSW development; surveys for the Vineyard Wind 1 and South Fork projects were considered in the Biological Opinions issued for those projects. Some gear types used, including gillnet, trawl, and trap/pot, can entangle or capture ESA listed sea turtles, fish, and whales. Risk can be reduced through avoiding certain times/areas, minimizing soak and tow times, and using gear designed to limit entanglement or reduce the potential for serious injury or mortality. To date, we have records of ten Atlantic sturgeon captured in gillnet surveys (for the South Fork project) in the action area; six of the sturgeon were released alive with minor injuries while the remaining four were killed. South Fork does not anticipate further gillnet survey efforts at this time. A number of Atlantic sturgeon and sea turtles have also been captured in trawl surveys; however, all animals have been released alive with no serious injuries observed. Risk can be reduced through avoiding certain times/areas, minimizing soak and tow times, and using gear designed to limit entanglement or reduce the potential for serious injury or mortality. Outside of the gillnet surveys, which are no longer planned, no serious injury or mortality of any ESA listed species resulting from fishery-related survey activities is exempted in any ITS issued for any of these projects.

Consideration of Construction, Operation, and Decommissioning of Other OSW Projects
We have completed ESA consultation for 12 OSW projects to date. Complete information on the assessment of effects of these 12 projects is found in their respective Biological Opinions (South Fork Wind - NMFS 2021, Vineyard Wind 1 - NMFS 2024, CVOW - NMFS 2016, Block Island - NMFS 2014, Ocean Wind – NMFS 2023, CVOW Commercial – NMFS 2023, Empire Wind – NMFS 2023, Revolution Wind – NMFS 2024, Sunrise Wind – 2023, Atlantic Shores South – 2023, New England Wind – 2024, Maryland Wind 2024). The South Fork, Block Island, and CVOW Demonstration projects have been fully constructed and turbines are operational. Construction of the Vineyard Wind 1, CVOW Commercial, and Revolution Wind projects are ongoing and expected to be complete prior to the beginning of construction of the SouthCoast Wind project. Given numerous project delays, it is difficult to predict which, if any, projects may be undergoing construction during the same years as the SouthCoast Wind project. We note that in January 2024, at the request of the lessee for the Ocean Wind 1 project\suspended their lease; as such, it is not clear if or when that project will be constructed in the future. The CVOW Demonstration and CVOW Commercial projects are within the SouthCoast Wind vessel transit routes in the action area. The Sunrise Wind and New England Wind lease areas are in the MA or RI/MA WEAs and are proximate to the SouthCoast Wind lease area and within the action area. The Atlantic Shores South and Empire Wind lease areas are within the portion of the action area that project vessels may transit. We provide more information below on the projects in the action area.

In the Biological Opinions prepared for these projects, we anticipated temporary loss of hearing sensitivity (TTS) and/or short term behavioral disturbance of ESA listed sea turtles and whales exposed to pile driving noise or UXO detonations resulting in take that meets the ESA definition of harassment and, in a few cases, anticipated permanent loss of hearing sensitivity (PTS) resulting in take that meets the definition of harm. The amount of incidental take exempted through project Biological Opinions is included below for the projects that occur in the SouthCoast Wind action area (Tables 6.3 and 6.4). In the Biological Opinions prepared for the offshore wind projects considered to date, we anticipated short term behavioral disturbance of ESA listed sea turtles and whales exposed to pile driving noise. In these Opinions, we concluded that effects of operational noise would be insignificant. With the exception of the gillnet interactions noted above, the only mortality anticipated is a small number of sea turtles and Atlantic sturgeon expected to be struck and injured or killed by vessels associated with the South Fork, Vineyard Wind 1, Ocean Wind 1, Empire Wind, Revolution Wind, Sunrise Wind, Atlantic Shores South, and New England Wind projects.

Table 6.4. Summary of available Incidental Take Statements (ITS) regarding project noise (pile driving and/or UXO detonations) for the following completed offshore wind consultations. Note that not all construction periods overlap. Source: Maryland Wind – 2024, Ocean Wind – NMFS 2023a, Empire Wind – NMFS 2023c, Revolution Wind – NMFS 2023d, Sunrise Wind – 2023e, Atlantic Shores South – 2023f, South Fork Wind - NMFS 2021a, Vineyard Wind 1 - NMFS 2021b, and New England Wind – 2023f.

South Fork Wind - Amount and Extent of Take Identified in the BiOp's ITS due to Noise Exposure (Impact and Vibratory Pile Driving)

Species	Harm (Auditory Injury -PTS)	Harassment (TTS/Behavior)
North Atlantic right whale	None	10
Fin Whale	1	15
Sei Whale	1	2
Sperm whale	None	3
NA DPS green sea turtle	None	6
Kemp’s ridley sea turtle	None	6
Leatherback sea turtle	None	8
NWA DPS Loggerhead sea turtle	None	6
Vineyard Wind 1 - Amount and Extent of Take Identified in the BiOp's ITS due to Noise Exposure (Maximum Impact Scenario; Impact Pile Driving Only)		
Species	Harm (Auditory Injury -PTS)	Harassment (TTS/Behavior)
North Atlantic right whale	None	20
Fin whale	5	5
Sei Whale	2	2
Sperm whale	None	None
NWA DPS Loggerhead sea turtle	None	3
NA DPS green sea turtle	None	1
Kemp’s ridley sea turtle	None	1
Leatherback sea turtle	None	7
Ocean Wind 1 - Amount and Extent of Take Identified in the BiOp's ITS due to Noise Exposure (Scenario 2; UXO Detonation and Impact and Vibratory Pile Driving)		
Species	Harm (Auditory Injury -PTS)	Harassment (TTS/Behavior)
North Atlantic right whale	None	7
Fin whale	4	15
Sei Whale	1	4
Sperm whale	None	9
Blue whale	None	4
NA DPS green sea turtle	None	1
Kemp’s ridley sea turtle	None	16

Leatherback sea turtle	None	7
NWA DPS Loggerhead sea turtle	None	184
Revolution Wind - Amount and Extent of Take Identified in the BiOp's ITS due to Exposure to Noise (UXO Detonation and Impact Pile Driving)		
Species	Harm (Auditory Injury -PTS)	Harassment (TTS/Behavior)
North Atlantic right whale	None	34
Fin whale	2	35
Sei Whale	3	18
Sperm whale	None	5
Blue whale	None	2
NA DPS green sea turtle	1	8
Kemp's ridley sea turtle	1	7
Leatherback sea turtle	1	7
NWA DPS Loggerhead sea turtle	1	15
Empire Wind - Amount and Extent of Take Identified in the BiOp's ITS due to Noise Exposure (Impact Pile Driving Only)		
Species	Harm (Auditory Injury -PTS)	Harassment (TTS/Behavior)
North Atlantic right whale	None	22
Fin whale	6	190
Sei Whale	None	5
Sperm whale	None	6
NA DPS green sea turtle	None	1
Kemp's ridley sea turtle	None	9
Leatherback sea turtle	None	2
NWA DPS Loggerhead sea turtle	None	96
Sunrise Wind - Amount and Extent of Take Identified in the BiOp's ITS due to Noise Exposure (Impact Pile Driving Only)		
Species	Harm (Auditory Injury -PTS)	Harassment (TTS/Behavior)
North Atlantic right whale	None	23
Fin whale	4	55

Sei Whale	2	22
Sperm whale	None	10
Blue whale	None	2
NA DPS green sea turtle	None	1
Kemp's ridley sea turtle	None	1
Leatherback sea turtle	4	9
Atlantic Shores South - Amount and Extent of Take Identified in the BiOp's ITS due to Noise Exposure (Impact Pile Driving Only)		
Species	Harm (Auditory Injury -PTS)	Harassment (TTS/Behavior)
North Atlantic right whale	None	20
Fin whale	8	28
Sei Whale	3	15
Sperm whale	None	10
NA DPS green sea turtle	None	2
Kemp's ridley sea turtle	None	48
Leatherback sea turtle	4	25
NWA DPS Loggerhead sea turtle	None	816
New England Wind – Amount and Extant of Take Identified in the BiOp's ITS due to Noise Exposure (UXO Detonation and Impact Pile Driving)		
Species	Harm (Auditory Injury – PTS)	Harassment (TTS/Behavior)
North Atlantic right whale	None	101
Fin whale	33	368
Sei Whale	6	58
Sperm whale	None	100
Blue whale	2	4
NA DPS green sea turtle	1	2
Kemp's ridley sea turtle	None	2
Leatherback sea turtle	7	14
NWA DPS Loggerhead sea turtle	3	18
Maryland Wind – Amount and Extant of Take Identified in the BiOp's ITS due to Noise Exposure (Impact Pile Driving)		

Species	Harm (Auditory Injury – PTS)	Harassment (TTS/Behavior)
North Atlantic right whale	None	6
Fin whale	None	37
Sei Whale	None	6
Sperm whale	None	None
NA DPS green sea turtle	None	22
Kemp's ridley sea turtle	None	1
Leatherback sea turtle	None	12
NWA DPS Loggerhead sea turtle	None	374
Atlantic Sturgeon – All 5 DPSs	None	None
Giant Manta Ray	None	None
Block Island – Amount and Extant of Take Identified in the BiOp's ITS due to Noise Exposure (Impact Pile Driving)		
Species	Harm (Auditory Injury – PTS)	Harassment (TTS/Behavior)
North Atlantic right whale	None	11
Humpback whale	None	22
Fin whale	None	228
NA DPS green sea turtle	None	64
Kemp's ridley sea turtle	None	64
Leatherback sea turtle	None	64
NWA DPS Loggerhead sea turtle	None	576
CVOW - Experimental – Amount and Extant of Take Identified in the BiOp's ITS due to Noise Exposure (Impact Pile Driving)		
Species	Harm (Auditory Injury – PTS)	Harassment (TTS/Behavior)
North Atlantic right whale	None	1
Humpback whale	None	98
Fin whale	None	1
NA DPS green sea turtle	None	328
Kemp's ridley sea turtle	None	1,064
Leatherback sea turtle	None	210

NWA DPS Loggerhead sea turtle	None	630
CVOW – Commercial -Amount and Extent of Take Identified in the BiOp's ITS due to Noise Exposure (Impact Pile Driving)		
Species	Harm (Auditory Injury – PTS)	Harassment (TTS/Behavior)
North Atlantic right whale	None	12
Sei Whale	2	5
Fin whale	7	202
Sperm whale	None	6
NA DPS green sea turtle	46	215
Kemp's ridley sea turtle	44	203
Leatherback sea turtle	4	3
NWA DPS Loggerhead sea turtle	1,214	5,764

Table 6.5. Summary of available Incidental Take Statements (ITS) regarding vessel strikes for the following completed offshore wind consultations. The amount of take identified is over the life of the project (construction, operations, and decommissioning). Source: Maryland Wind – 2024, Ocean Wind – NMFS 2023a, Empire Wind – NMFS 2023c, Revolution Wind – NMFS 2023d, Sunrise Wind – 2023e, New England Wind – 2023f, Atlantic Shores South – 2023f, South Fork Wind - NMFS 2021a, and Vineyard Wind 1 - NMFS 2021b.

South Fork Wind - Amount and Extent of Take Identified in the BiOp's ITS due to Vessel Strike	
Species	Serious Injury or Mortality
NA DPS green sea turtle	1
Kemp's ridley sea turtle	1
Leatherback sea turtle	7
NWA DPS Loggerhead sea turtle	3
Vineyard Wind 1 - Amount and Extent of Take Identified in the BiOp's ITS Due to Vessel Strike	
Species	Serious Injury or Mortality
NWA DPS Loggerhead sea turtle	17
NA DPS green sea turtle	2
Kemp's ridley sea turtle	2
Leatherback sea turtle	20
South Fork Wind - Amount and Extent of Take Identified in the BiOp's ITS due to Vessel Strike	

Species	Serious Injury of Mortality
NA DPS green sea turtle	1
Kemp’s ridley sea turtle	1
Leatherback sea turtle	7
NWA DPS Loggerhead sea turtle	3
Ocean Wind 1 - Amount and Extent of Take Identified in the BiOp's ITS due to Vessel Strike	
Species	Serious Injury or Mortality
NA DPS green sea turtle	1
Kemp’s ridley sea turtle	1
Leatherback sea turtle	1
NWA DPS Loggerhead sea turtle	9
Revolution Wind -Amount and Extent of Take Identified in the BiOp's ITS due to Vessel Strike	
Species	Serious Injury or Mortality
North Atlantic DPS green sea turtle	1
Kemp’s ridley sea turtle	1
Leatherback sea turtle	5
Northwest Act DPS Loggerhead sea turtle	6
Empire Wind - Amount and Extent of Take Identified in the BiOp's ITS due to Vessel Strike	
Species	Serious Injury or Mortality
North Atlantic DPS green sea turtle	1
Kemp’s ridley sea turtle	3
Leatherback sea turtle	4
Northwest Atlantic DPS Loggerhead sea turtle	22
Sunrise Wind - Amount and Extent of Take Identified in the BiOp's ITS due to Vessel Strike	
Species	Serious Injury or Mortality
North Atlantic DPS green sea turtle	1
Kemp’s ridley sea turtle	1
Leatherback sea turtle	5
Northwest Atlantic DPS Loggerhead sea turtle	6
Atlantic Shores South - Amount and Extent of Take Identified in the BiOp's ITS due to Vessel Strike	

Species	Serious Injury or Mortality
North Atlantic DPS green sea turtle	2
Kemp’s ridley sea turtle	3
Leatherback sea turtle	2
Northwest Atlantic DPS Loggerhead sea turtle	21
New England Wind - Amount and Extent of Take Identified in the BiOp's ITS due to Vessel Strike	
Species	Serious Injury or Mortality
North Atlantic DPS green sea turtle	2
Kemp’s ridley sea turtle	2
Leatherback sea turtle	22
Northwest Atlantic DPS Loggerhead sea turtle	28
NYB DPS Atlantic Sturgeon	1
Shortnose Sturgeon	1
Maryland Wind - Amount and Extent of Take Identified in the BiOp's ITS due to Vessel Strike	
Species	Serious Injury or Mortality
North Atlantic DPS green sea turtle	4
Kemp’s ridley sea turtle	20
Leatherback sea turtle	6
Northwest Atlantic DPS Loggerhead sea turtle	116
NYB DPS Atlantic Sturgeon	5
Chesapeake Bay DPS Atlantic Sturgeon	1
Chesapeake Bay, South Atlantic OR Gulf of Maine DPS Atlantic Sturgeon	2
Shortnose Sturgeon	2
CVOW Commercial - Amount and Extent of Take Identified in the BiOp's ITS due to Vessel Strike	
Species	Serious Injury or Mortality
NA DPS green sea turtle	13
Kemp’s ridley sea turtle	101
Leatherback sea turtle	5
NWQ DPS Loggerhead sea turtle	249
New York Bight DPS Atlantic Sturgeon	113

Chesapeake Bay DPS Atlantic Sturgeon	47
Carolina DPS Atlantic Sturgeon	11
South Atlantic DPS Atlantic Sturgeon	25
Gulf of Maine DPS Atlantic Sturgeon	5

Vineyard Wind Blade Failure and Emergency Response Actions
On July 13, 2024, during commissioning of one of the Vineyard Wind WTGs, a single turbine blade broke. This resulted in the immediate release of a portion of the blade into the ocean; additional debris fell into the water over the following weeks. At the time this Opinion was being written, emergency response activities, including clean-up of blade debris was ongoing. The associated activities carried out to date include use of vessels, removal of debris from the water and shoreline, multibeam sonar surveys to identify debris on the ocean bottom, and removal of debris from the bottom. To date, no interactions with any ESA listed species have been observed or reported.

In response to a July 31, 2024 request from BOEM, an emergency ESA Section 7 consultation has been initiated and is ongoing regarding the effects of emergency response activities being carried out in response to the July 13 blade failure. We have provided recommendations to minimize effects to ESA-listed species during the response action through that consultation process. Once the emergency response actions are complete, that consultation will be completed. At this time we are not aware of any take of any ESA listed species that has occurred as a result of the blade failure or any associated emergency response activities.

Other Activities in the Action Area
Other activities that occur in the action area that may affect listed species include scientific research and geophysical and geotechnical surveys. Military operations in the action area are expected to be restricted to vessel transits, the effects of which are subsumed in the discussion of vessel strikes above.

Scientific Surveys

A variety of scientific surveys, including fisheries and ecosystem research and monitoring surveys are conducted in the region by state and federal agencies (including NMFS), academic institutions, and non-governmental organizations using an array of platforms including ships, autonomous vehicles, buoys, moorings, and satellites. Research and monitoring efforts include measuring the physical and biological structure of the ocean environment such as temperature, chlorophyll, and salinity at a range of depths. Additionally, long-term shelf-wide surveys provide data used to estimate spawning stock biomass, overall fish biodiversity, zooplankton abundance, information on the timing and location of spawning events, marine mammal and sea turtle abundance, and insight to detect changes in the environment. Many of these surveys provide information that aids in the management of listed species and the ecosystems on which they depend. Some surveys may result in the directed or incidental take of ESA listed species. Regulations issued to implement section 10(a) (1)(A) of the ESA allow issuance of permits authorizing take of ESA-listed species for the purposes of scientific research. Prior to the issuance of such a permit, an ESA Section 7 consultation must take place. No permit can be issued unless the proposed research is determined to be not likely to jeopardize the continued existence of any listed species. Scientific research permits are issued by NMFS for ESA listed whales and Atlantic sturgeon; the U.S. Fish and Wildlife Service is the permitting authority for ESA listed sea turtles.

Marine mammals, sea turtles, and Atlantic sturgeon have been the subject of field studies for decades. The primary objective of most of these field studies has generally been monitoring populations or gathering data for behavioral and ecological studies. Research on ESA listed whales, sea turtles, and Atlantic sturgeon has occurred in the action area in the past and is expected to continue over the life of the proposed action. Authorized research on ESA-listed whales includes close vessel and aerial approaches, photographic identification, photogrammetry, biopsy sampling, tagging, ultrasound, exposure to acoustic activities, breath sampling, behavioral observations, passive acoustic recording, and underwater observation. No lethal interactions are anticipated in association with any of the permitted research. ESA-listed sea turtle research includes approach, capture, handling, restraint, tagging, biopsy, blood or tissue sampling, lavage, ultrasound, imaging, antibiotic (tetracycline) injections, laparoscopy, and captive experiments. Most authorized take is sub-lethal with limited amounts of incidental mortality authorized in some permits (i.e., no more than one or two incidents per permit and only a few individuals overall). Authorized research for Atlantic sturgeon includes capture, collection, handling, restraint, internal and external tagging, blood or tissue sampling, gastric lavage, and collection of morphometric information. Most authorized take of Atlantic sturgeon for research activities is sub-lethal with small amounts of incidental mortality authorized; a programmatic ESA Section 7 consultation was issued in 2017 that identifies a limit on lethal take for each river population (NMFS OPR 2017); depending on the identified health of the river population, the allowable mortality limit, across all issued permits, ranges from 0.4 to 0.8%. In that Opinion, NMFS determined this was not likely to jeopardize the continued existence of any DPS.

Noise

The ESA-listed species that occur in the action area are regularly exposed to several sources of anthropogenic sounds in the action area. The major source of anthropogenic noise in the action area are vessels. Other sources are minor and temporary including short-term dredging, construction, and research activities. As described in the COP II, typically, military training exercises occur in deeper offshore waters southeast of the lease area, though transit of military vessels may occur throughout the area; therefore, while military operations can be a significant source of underwater noise that is not the case in the action area. ESA-listed species may be impacted by either increased levels of anthropogenic-induced background sound or high intensity, short- term anthropogenic sounds.

The SouthCoast Wind WDA lies within a dynamic ambient noise environment, with natural background noise contributed by natural wind and wave action, a diverse community of vocalizing cetaceans, and other organisms. Anthropogenic noise sources, including commercial shipping traffic in high-use shipping lanes in proximity to the action area, also contribute ambient sound. Kraus et al. (2016) surveyed the ambient underwater noise environment in the RI/MA WEA as part of a broader study of large whale and sea turtle use of marine habitats in this wind energy development area. Acoustic monitoring sensor locations in and around the

RI/MA WEA are depicted in Figure 11 of Kraus et al. (2016). As shown, sensors RI-1, RI-2, and RI-3 effectively surround the South Fork Wind Farm, whereas the remaining sensor locations are in the more seaward portion of the WEA. Figure 12 (in Kraus et al. 2016) displays 50th percentile power spectral density and cumulative percentile distribution of peak ambient sound levels measured between November 2011 and March 2015. Depending on location, ambient underwater sound levels within the RI/MA WEA varied from 96 to 103 dB in the 70.8- to 224-Hz frequency band at least 50% of the recording time, with peak ambient noise levels reaching as high as 125 dB on the western side of the South Fork Wind Farm in proximity to the Narraganset Bay and Buzzards Bay shipping lanes (Kraus et al. 2016). Low-frequency sound from large marine vessel traffic in these and other major shipping lanes to the east (Boston Harbor) and south (New York) are the dominant sources of underwater noise in the action area.

Van Parijs et al (2023) evaluated baseline ambient sound levels in the RI/MA WEA for two years from 2021 through 2022. Acoustic monitors were placed in Nantucket Shoals in 2022 and in two WDAs directly adjacent to the SouthCoast WDA in 2021 (Figure 1 in Van Parijs et al, 2023) to capture ambient sound pressure levels (SPLs). Median broadband SPLs from ambient noise ranged from 105 to 112 dB while decidecade SPLs varied across sites and seasons (Figure 7 of Van Parijs et al, 2023). With vessel noise being a major contributor to ambient noise in the region, the additional vessel traffic from wind energy area development will increase underwater noise levels, especially during the high traffic times during the construction phases.

Short term increases in noise in the action area associated with vessel traffic and other activities, including geotechnical and geophysical surveys that have taken place in the past and will continue in the future in the portions of the action area that overlap with other offshore wind lease areas and/or potential cable routes. Exposure to these noise sources can result in temporary masking or temporary behavioral disturbance; however, in all cases, these effects are expected to be temporary and short term (e.g., the seconds to minutes it takes for a vessel to pass by) and not result in any injury or mortality in the action area. No acoustic surveys using seismic equipment or airguns have been proposed in the action area and none are anticipated to take place in the future, as that equipment is not necessary to support siting of future offshore wind development that is anticipated to occur in the action area.

Factors Relevant only for the Gulf of Mexico portion of the Action Area
In addition to fishing activities and vessel operations, oil and gas exploration and extraction activities occur in the Gulf of Mexico as do a number of military activities. The air space over the Gulf of Mexico is used extensively by the Department of Defense for conducting various air-to-air and air-to-surface operations. Nine military warning areas and five water test areas are located within the Gulf of Mexico. The western Gulf of Mexico has four warning areas that are used for military operations. In addition, six blocks in the western Gulf of Mexico are used by the Navy for mine warfare testing and training. The central Gulf of Mexico has five designated military warning areas that are used for military operations. Oil and gas operations on the Gulf of Mexico OCS that have been ongoing for more than 50 years involve a variety of activities that may adversely affect ESA-listed species in the action area. These activities and resulting impacts include vessels making supply deliveries, drilling operations, seismic surveys, fluid spills, oil spills and response, and oil platform removals. NMFS Biological Opinion on the Federally Regulated Oil and Gas Program Activities in the Gulf of Mexico addresses a number

of stressors including vessel interactions (lethal and non-lethal), noise exposure (pile driving, seismic surveys, explosives), entanglement/capture, marine debris, and oil spills. Biological Opinions issued by NMFS, with the accompanying Incidental Take Statement, are available on NMFS webpage (https://www.fisheries.noaa.gov/national/endangered-species-conservation/biological-opinions-noaa-fisheries-office-protected, also the SERO page listed above); these include consultations on oil and gas activities, fisheries, military activities, and dredging/channel maintenance. Lethal and non-lethal incidental take, as described in these Opinions, is expected to continue over the life of the SouthCoast project.

Other Factors

Whales, sea turtles, and Atlantic sturgeon are exposed to a number of other stressors in the action area that are widespread and not unique to the action area which makes it difficult to determine to what extent these species may be affected by past, present, and future exposure within the action area. These stressors include water quality and marine debris. Marine debris in some form is present in nearly all parts of the world's oceans, including the action area. While the action area is not known to aggregate marine debris as occurs in some parts of the world (e.g., The Great Pacific garbage patch, also described as the Pacific trash vortex, a gyre of marine debris particles in the north central Pacific Ocean), marine debris, including plastics that can be ingested and cause health problems in whales and sea turtles is expected to occur in the action area.

Marine ecosystems are described using the Coastal and Marine Ecological Classification Standard (CMECS), a classification system based on biogeographic setting for the area of interest (FGDC 2012). CMECS provides a comprehensive framework for characterizing ocean and coastal environments and living systems using categorical descriptors for physical, biological, and chemical parameters relevant to each specific environment type (FGDC 2012). The CMECS biogeographic setting for the WDA is the Temperate Northern Atlantic Realm, Cold Temperate Northwest Atlantic Province, and Virginian Ecoregion. The biotic component of CMECS classifies living organisms of the sea floor and water column based on physical habitat associations across a range of spatial scales. This component is organized into a five-level branched hierarchy: biotic setting, biotic class, biotic subclass, biotic group, and biotic community. The biotic subclass is a useful classification category for characterizing the aquatic ecosystem. Biotic component classifications in the WDA are defined by the dominance of life forms, taxa, or other classifiers observed in surveys of the site. In the case of photos, dominance is assigned to the taxa with the greatest percent cover in the photo (FGDC 2012).

The cable corridor is located in coastal marine waters where available water quality data are also limited. The EPA classified coastal water quality conditions nationally for the 2010 National Coastal Condition Assessment (EPA 2016). The 2010 National Coastal Condition Assessment used physical and chemical indicators to rate water quality, including phosphorus, nitrogen, dissolved oxygen, salinity, water clarity, pH, and chlorophyll *a*. The most recent National Coastal Condition Report rated coastal water quality from Maine to North Carolina as "good" to "fair" (EPA 2012). This survey included four sampling locations near the WDA, all of which were within Block Island Sound. EPA (2016) rated all National Coastal Condition Report parameters in the fair to good categories at all four of these locations.

The WDA is located in temperate waters and, therefore, subjected to highly seasonal variation in temperature, stratification, and productivity. Overall, pelagic habitat quality within the WFA and offshore components of the cable corridor is considered fair to good (USEPA 2015). Baseline conditions for water quality are further described below. Section 4.3 of the COP II details oceanographic conditions in the WFA and surrounding area. Circulation patterns in the Lease Area and vicinity are influenced by water moving in from Block Island Sound and the colder water coming in from the Gulf of Maine with a net transport of water from Rhode Island Sound towards the southwest and west. While the net surface transport is to the southwest and west, bottom water may flow toward the north, particularly during the winter (Rhode Island Coastal Resources Management Council [RI CRMC] 2010).

Ocean waters beyond 3 miles (4.8 km) offshore typically have low concentrations of suspended particles and low turbidity. Waters along the Northeast Coast average 5.6 milligrams per liter (mg/L) of TSS, which is considered low. There are notable exceptions, including estuaries that average 27.4 mg/L (EPA 2012). While most ocean waters had TSS concentrations under 10 mg/L, which is the 90th percentile of all measured values, most estuarine waters (65.7% of the Northeast Coast area) had TSS concentrations above this level. Near-bottom TSS concentrations were similar to those near the water surface, averaging 6.9 mg/L. With the exception of the entrance to Delaware Bay, all other coastal ocean stations had near-bottom levels of TSS less than or equal to 16.3 mg/L (EPA 2012).

A study conducted by the EPA evaluated over 1,100 coastal locations in 2010, as reported in their National Coastal Condition Assessment (EPA, 2015). The EPA used a Water Quality Index (WQI) to determine the quality of various coastal areas including the northeast coast from Virginia to Maine and assigned three condition levels for a number of constituents: good, fair, and poor. A number of the sample locations overlap with the action area. Chlorophyll a concentrations, an indicator of primary productivity, levels in northeastern coastal waters were generally rated as fair (45%) to good (51%) condition, and stations in the action area were all also fair to good (EPA, 2015). Nitrogen and phosphorous levels in northeastern coastal waters generally rated as fair to good (13% fair and 82% good for nitrogen and 62% and 26% good for phosphorous); stations in the action area were all also fair to good (EPA 2015). Dissolved oxygen levels in northeastern coastal waters are generally rated as fair (14%) to good (80%) condition, with consistent results for the sampling locations in the action area. Based on the available information, water quality in the action area appears to be consistent with surrounding areas. We are not aware of any discharges to the action area that would be expected to result in adverse effects to listed species or their prey. Outside of conditions related to climate change, discussed in Section 7.10, water quality is not anticipated to negatively affect listed species that may occur in the action area.

7.0 EFFECTS OF THE ACTION

This section of the biological opinion assesses the effects of the proposed action on ESA-listed threatened or endangered species and designated critical habitat. Effects of the action are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (50 CFR §402.02 and § 402.17).

The main element of the proposed action is BOEM's COP approval with conditions, the effects of which will be analyzed in this section. The effects of the issuance of other permits and authorizations that are consequences of BOEM's action are also evaluated in this section. For example, the Incidental Take Regulations (ITR) and associated LOA proposed for issuance by NMFS OPR to authorize incidental take of ESA-listed marine mammals under the MMPA and the permits/authorizations proposed for issuance by USACE and EPA are considered effects of the action as they are consequences of BOEM's approval of SouthCoast Wind's COP with conditions. In addition, the ITR and associated LOA proposed by NMFS OPR, as well as permits issued by USACE and EPA, are also Federal actions that may affect ESA-listed species; therefore, they require Section 7 consultation in their own right. In this consultation, we have worked with NMFS OPR as the action agency authorizing marine mammal incidental takes under the MMPA, as well as with other Federal action agencies aside from BOEM that are proposing to issue permits or other approvals, and we have analyzed the effects of those actions along with the effects of BOEM's action to approve the COP with conditions. All effects of these collective actions on ESA-listed species and designated critical habitat are, therefore, comprehensively analyzed in this Opinion.[32]

The purpose of the SouthCoast Wind project is to generate electricity. Electricity will travel from the WTGs to the OSPs and then by submarine cable to on-land cables in New England. All of the electricity generated is expected to support existing uses. Even if we assume the SouthCoast Wind project will increase overall supply of electricity, we are not aware of any new actions demanding electricity that would not be developed but for the SouthCoast Wind project specifically. Because the electricity generated by SouthCoast Wind will be pooled with that of other sources in the power grid, we are unable to trace any particular new use of electricity to SouthCoast Wind's contribution to the grid and, therefore, we cannot identify any impacts, positive or negative, that would occur because of the SouthCoast Wind project's supply of electricity to the grid. As a result, there are no identifiable consequences of the proposed action analyzed in this Opinion that would not occur but for SouthCoast Wind's production of electricity and are reasonably certain to occur.

Here, we examine the activities associated with the proposed action and determine what the consequences of the action are to listed species in the action area. Effects to critical habitat were addressed in Section 4.0 *Species and Critical Habitat Not Considered Further* of this Opinion. A consequence is caused by the action if it would not occur but for the proposed action and it is reasonably certain to occur. In analyzing effects, we evaluate whether a source of impacts is "likely to adversely affect" listed species/critical habitat or "not likely to adversely affect" listed species/critical habitat. A "not likely to adversely affect" determination is appropriate when an activity may affect a listed species but the effect is expected to be discountable, insignificant, or completely beneficial. As discussed in the FWS-NMFS Joint Section 7 Consultation Handbook (1998), "[b]eneficial effects are contemporaneous positive effects without any adverse effects to

[32] The term "proposed action" or "action" may be used to refer to all action agencies' actions related to the SouthCoast Wind project, unless specific context reveals otherwise.

the species. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur. Based on best judgment, a person would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur. If an effect is beneficial, discountable, or insignificant it is not considered adverse and thus cannot cause "take" of any listed species. "Take" means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct" (ESA §3(19)).

7.1 Underwater Noise

In this section, we provide background information on underwater noise and how it affects listed species, establish the underwater noise that listed species are likely to be exposed to, and then establish the expected response of the individuals exposed to that noise. This analysis considers all phases of the proposed action inclusive of construction, operations, and decommissioning.

7.1.1 Background on Noise

This section contains a brief technical background on sound, the characteristics of certain sound types, and metrics used in this consultation inasmuch as the information is relevant to the specified activity and to consideration of the potential effects of the specified activity on listed species found later in this document.

Sound travels in waves, the basic components of which are frequency, wavelength, velocity, and amplitude. Frequency is the number of pressure waves that pass by a reference point per unit of time and is measured in hertz (Hz) or cycles per second. Wavelength is the distance between two peaks or corresponding points of a sound wave (length of one cycle). Higher frequency sounds have shorter wavelengths than lower frequency sounds, and typically attenuate (decrease) more rapidly, except in certain cases in shallower water. Amplitude is the height of the sound pressure wave or the "loudness" of a sound and is typically described using the relative unit of the decibel (dB). A sound pressure level (SPL) in dB is described as the ratio between a measured pressure and a reference pressure (for underwater sound, this is 1 microPascal (μPa)), and is a logarithmic unit that accounts for large variations in amplitude; therefore, a relatively small change in dB corresponds to large changes in sound pressure. The source level (SL) typically represents the SPL referenced at a distance of 1 m from the source, while the received level is the SPL at the listener's position (referenced to 1 μPa).

Root mean square (rms) is the quadratic mean sound pressure over the duration of an impulse. Root mean square is calculated by squaring all of the sound amplitudes, averaging the squares, and then taking the square root of the average (Urick, 1983). Root mean square accounts for both positive and negative values; squaring the pressures makes all values positive so that they may be accounted for in the summation of pressure levels (Hastings and Popper, 2005). This measurement is often used in the context of discussing behavioral effects, in part because behavioral effects, which often result from auditory cues, may be better expressed through averaged units than by peak pressures.

Sound exposure level (SEL; represented as dB re 1 μPa^2-s) represents the total energy in a stated frequency band over a stated time interval or event, and considers both intensity and duration of exposure. The per-pulse SEL is calculated over the time window containing the entire pulse (*i.e.*, 100 percent of the acoustic energy). SEL is a cumulative metric; it can be accumulated over a single pulse, or calculated over periods containing multiple pulses. Cumulative SEL represents the total energy accumulated by a receiver over a defined time window or during an event. Peak sound pressure (also referred to as zero-to-peak sound pressure or 0-pk) is the maximum instantaneous sound pressure measurable in the water at a specified distance from the source, and is represented in the same units as the rms sound pressure.

When underwater objects vibrate or activity occurs, sound-pressure waves are created. These waves alternately compress and decompress the water as the sound wave travels. Underwater sound waves radiate in a manner similar to ripples on the surface of a pond and may be either directed in a beam or beams or may radiate in all directions (omnidirectional sources), as is the case for sound produced by the pile driving activity considered here. The compressions and decompressions associated with sound waves are detected as changes in pressure by aquatic life and man-made sound receptors such as hydrophones.

Even in the absence of sound from the specified activity, the underwater environment is typically loud due to ambient sound, which is defined as environmental background sound levels lacking a single source or point (Richardson *et al*., 1995). The sound level of a region is defined by the total acoustical energy being generated by known and unknown sources. These sources may include physical (*e.g.*, wind and waves, earthquakes, ice, atmospheric sound), biological (*e.g.*, sounds produced by marine mammals, fish, and invertebrates), and anthropogenic (*e.g.*, vessels, dredging, construction) sound. A number of sources contribute to ambient sound, including wind and waves, which are a main source of naturally occurring ambient sound for frequencies between 200 hertz (Hz) and 50 kilohertz (kHz) (Mitson, 1995). In general, ambient sound levels tend to increase with increasing wind speed and wave height. Precipitation can become an important component of total sound at frequencies above 500 Hz, and possibly down to 100 Hz during quiet times. Marine mammals can contribute significantly to ambient sound levels, as can some fish and snapping shrimp. The frequency band for biological contributions is from approximately 12 Hz to over 100 kHz. Sources of ambient sound related to human activity include transportation (surface vessels), dredging and construction, oil and gas drilling and production, geophysical surveys, sonar, and explosions. Vessel noise typically dominates the total ambient sound for frequencies between 20 and 300 Hz. In general, the frequencies of anthropogenic sounds are below 1 kHz and, if higher frequency sound levels are created, they attenuate rapidly.

The sum of the various natural and anthropogenic sound sources that comprise ambient sound at any given location and time depends not only on the source levels (as determined by current weather conditions and levels of biological and human activity) but also on the ability of sound to propagate through the environment. In turn, sound propagation is dependent on the spatially and temporally varying properties of the water column and sea floor, and is frequency-dependent. As a result of the dependence on a large number of varying factors, ambient sound levels can be expected to vary widely over both coarse and fine spatial and temporal scales. Sound levels at a given frequency and location can vary by 10-20 decibels (dB) from day to day (Richardson *et al*., 1995). The result is that, depending on the source type and its intensity, sound from the specified activity may be a negligible addition to the local environment or could form a distinctive signal that may affect a particular species. As described in the BA, the WDA lies within a dynamic ambient noise environment, with natural background noise contributed by natural wind and wave action, a diverse community of vocalizing cetaceans, and other organisms. Anthropogenic noise sources, including commercial shipping traffic in high-use shipping lanes in proximity to the WDA, also contribute ambient sound; these sources are described in the *Environmental Baseline*.

Sounds are often considered to fall into one of two general types: pulsed and non-pulsed. The distinction between these two sound types is important because they have differing potential to cause physical effects, particularly with regard to hearing (*e.g.*, Ward, 1997 in Southall *et al*., 2008). Non-impulsive sounds can be tonal, narrowband, or broadband, brief or prolonged, and may be either continuous or intermittent (ANSI, 1995; NIOSH, 1998).

Pulsed sound sources (*e.g.*, impact pile driving) produce signals that are brief (typically considered to be less than one second), broadband, atonal transients (ANSI, 1986, 2005; Harris, 1998; NIOSH, 1998; ISO, 2003) and occur either as isolated events or repeated in some succession. Pulsed sounds are all characterized by a relatively rapid rise from ambient pressure to a maximal pressure value followed by a rapid decay period that may include a period of diminishing, oscillating maximal and minimal pressures, and generally have an increased capacity to induce physical injury as compared with sounds that lack these features.

Non-pulsed sounds can be tonal, narrowband, or broadband, brief or prolonged, and may be either continuous or intermittent (ANSI, 1995; NIOSH, 1998). Some of these non-pulsed sounds can be transient signals of short duration but without the essential properties of pulses (*e.g.*, rapid rise time). Examples of non-pulsed sounds include those produced by vessels, aircraft, drilling or dredging, and vibratory pile driving.

Specific to pile driving, the impulsive sound generated by impact hammers is characterized by rapid rise times and high peak levels. Vibratory hammers produce non-impulsive, continuous noise at levels significantly lower than those produced by impact hammers. Rise time is slower, reducing the probability and severity of injury, and sound energy is distributed over a greater amount of time (*e.g.*, Nedwell and Edwards, 2002; Carlson *et al*., 2005).

7.1.2 Summary of Available Information on Sources of Increased Underwater Noise

During the construction phase of the project, sources of increased underwater noise include pile driving (vibratory and impact), potential detonation of UXO/MECs, vessel operations, and other underwater construction activities (cable laying, placement of scour protection) as well as HRG surveys. During the operations and maintenance phase of the project, sources of increased underwater noise include WTG operations, vessel operations, and maintenance activities including occasional HRG surveys. During decommissioning, sources of increased underwater noise include removal of project components and associated surveys, as well as vessel operations. Here, we present a summary of available information on these noise sources. More detailed information is presented in the acoustic modeling reports produced for the project (Limpert et al. 2024, Hannay and Zykov 2022), SouthCoast's Revised Application for an ITA (LGL 2024)[33], the Proposed Rule prepared for the ITA (89 FR 53708; June 27, 2024), and

[33] Available at: https://www.fisheries.noaa.gov/action/incidental-take-authorization-southcoast-wind-llc-construction-southcoast-wind-offshore-wind; last accessed September 19, 2024.

BOEM's final June 2024 BA (BOEM 2024). Updated information is included in NMFS OPR's November 1, 2024 update memo and SouthCoast's updated modeling to consider the 2024 Updated Technical Guidance (LGL 2024 and attachments).

Pile Driving for WTG and OSP Foundations
As described in Section 3.0 *Description of the Proposed Action*, the proposed action considered in this consultation includes the installation of up to 147 WTG foundations and up to 2 OSP foundations. We note that the PDE described in the COP includes up to 5 OSP foundations but the proposed action addressed in the MMPA Proposed Rule is limited to installation of 1 OSP foundation per project, with each OSP foundation consisting of 4-16 4.5-m diameter pin piles. All monopiles would have a maximum diameter tapering from 9 m above the waterline to 16 m below the waterline (referred to herein as 9/16-m monopile). OSP jacket foundations are expected to be "post-piled"; post-piling means that the jacket structure is placed on the seafloor and piles are subsequently driven through guides at the base of each leg. WTG jacket foundations would be "pre-piled" (meaning that pin piles would be installed first, and the jacket structure would be set on those pre-installed piles) and have up to four legs, with each pin pile be up to 4.5 m diameter. Consistent with the MMPA ITA Proposed Rule, we consider five pile driving scenarios in this analysis:

- **Project 1**
  - Scenario 1: 71 monopile WTG foundations, 1 pin-piled jacket OSP foundation – impact pile driving only
  - Scenario 2: 85 pin-piled jacket WTG foundations, 1 pin-piled jacket OSP foundation – impact pile driving only
- **Project 2**
  - Scenario 1: 68 monopile WTG foundations, 1 pin-piled jacket OSP foundation – impact pile driving only
  - Scenario 2: 73 monopile WTG foundations, 1 pin-piled jacket OSP foundation – impact and vibratory pile driving
  - Scenario 3: 62 pin-piled jacket WTG foundations, 1 pin-piled jacket OSP foundation – impact and vibratory pile driving

If suction bucket foundations are selected for Project 2, pile driving would not be necessary for those foundations. At this time, one construction season is planned for each project. However, it is possible that more than one construction season could be needed depending on supply chain and vessel availability, weather delays, etc. which could result in foundation installation occurring in more than two calendar years. Consistent with the requirements of the proposed MMPA ITA and proposed conditions of COP approval, foundation pile driving activities will not occur from January 1 through May 15 in any portion of the Lease Area. Additionally, from October 16 through May 31, impact and vibratory pile driving will not occur at locations within the North Atlantic right whale Enhanced Mitigation Area (NARW EMA; defined as 20 km (12.4 mi) of the 30-m (98-ft) isobath on the west side of Nantucket Shoals, see Figure 3.X). SouthCoast anticipates installing one or two monopile foundations per day or up to four pin piles per day. The only concurrent pile driving (i.e., more than one pile being installed at the same time) that is proposed is on up to four days for each project when both a WTG foundation (one monopile or four pin piles) and four OSP pin piles could be installed. Outside of these limited number of days, pile driving would occur sequentially (i.e., only one pile being installed at a time). Installation of more than two monopiles per day is not considered as part of the proposed action analyzed here.

Wind Turbine Generator (WTG) Foundation Installation
WTGs would be installed on monopiles (up to 16 m diameter) or pre-piled jacket foundations (four 4.5-m pin piles). SouthCoast would install WTG monopiles using an impact pile driver with a maximum hammer energy of 6,600 kJ for a total of 7,000 strikes (including soft-start hammer strikes) at a rate of 30 strikes per minute to a total maximum penetration depth of 50 m. For pile installations utilizing vibratory pile driving as well (Project 2 only), this impact installation sequence would be preceded by use of a vibratory hammer to drive the pile to a depth that is sufficient to fully support the structure before beginning the soft-start and subsequent impact hammering. For these piles, SouthCoast would use a vibratory hammer followed by a maximum of 5,000 impact hammer strikes (including soft-start) using the same hammer and parameters specified above. Under typical conditions, impact installation of a single monopile foundation is estimated to require up to 4 hours of active impact pile driving (7,000 strikes/30 strikes per minute equals approximately 233 minutes, or 3.9 hours). For installations requiring vibratory and impact pile driving, the installation duration is also expected to last approximately 4 hours, beginning with 20 minutes of active vibratory driving, followed by short period during which the hammer set-up would be changed from vibratory to impact, after which impact installation would begin with a 20-minute soft-start (5,000 strikes/30 strikes per minute equals approximately 167 minutes, or 2.8 hours). Representative hammering schedules of increasing hammer energy with increasing penetration depth were modeled, resulting in generally higher intensity sound fields as the hammer energy and penetration increases (Table 7.1.1 and 7.1.2).

For Project 1 and/or 2, jacket foundations (consisting of up to 4 pin piles) could be used instead of monopiles for WTG foundations. Jackets are large lattice structures made of steel tubes welded together and supported by securing piles (*i.e.*, pin piles). For installations requiring only impact pile driving, SouthCoast would install pin piles using an impact pile driver with a maximum hammer energy of 3,500 kJ for a total of 4,000 strikes (including soft-start hammer strikes) at a rate of 30 strikes per minute to a maximum penetration depth of 70 m. For pile installations utilizing vibratory pile driving as well (Project 2 only), this impact pile driving sequence would only begin after SouthCoast utilized a vibratory hammer to set the pile to a depth providing adequate stability. Subsequent impact hammering (using the same hammer specified) above would require fewer strikes (n=2,667) to drive the pile to the final 70-m maximum penetration depth. Under typical conditions, impact-only installation of each pin pile is estimated to require approximately 2 hours of active impact pile driving (4,000 strikes/30 strikes per minute equals approximately 133 minutes, or 2.2 hours), for a maximum of 8.8 hours total for a single WTG or OSP pin- piled jacket foundation supported by 4 pin piles. For each pin pile requiring vibratory and impact pile driving, the installation would begin with 90 minutes of vibratory hammering per pin pile, and would require fewer hammer strikes per pile over a shorter duration compared to impact-only installations (2,667 strikes/30 strikes per minute equals approximately 89 minutes, or 1.5 hours), for a total of approximately 12 hours of pile driving (vibratory and impact) to install 4 pin piles. Pile driving would occur continuously or intermittently, with installations requiring both methods of pile driving punctuated by the time required to change from the vibratory to the impact hammer. SouthCoast estimates that they could install a maximum of four pin piles per day, assuming use of a single installation vessel and 24-hour pile driving operations. Installation of more than four WTG pin piles per day is not considered as part of the proposed action analyzed here.

Offshore Substation Platform (OSP) Installation
The SouthCoast COP PDE includes up to 5 OSPs, with installation on monopiles or pin pile jacket foundations (up to 27 piles per foundation). In the MMPA Proposed Rule, NMFS OPR considers the installation of up to 32 pin piles for OSP foundation installation (total for both projects), with up to 16 OSP pin piles installed per project. This results in an expected up to four days of OSP pile installation for each project (up to four piles per day). All OSP monopile and pin-piled jacket foundations would be installed using only impact pile driving. As noted above, the only concurrent pile driving that is considered part of the proposed action is when OSP foundation pile driving occurs on the same day as WTG foundation pile driving; this is not expected to occur on more than 8 days total (4 days per project).

Installation of an OSP monopile foundation would follow the same parameters (*e.g.*, pile diameter, hammer energy, penetration depth) and procedure as previously described for WTG monopiles. Installation of OSP piled jacket foundations would be similar to that described for WTG piled jacket foundations but would be installed using a post-piling, rather than pre-piling, installation sequence. In this sequence, the seabed is prepared, the jacket is set on the seafloor, and the piles are driven through the jacket legs to the designed penetration depth. The piles are connected to the jacket via grouted and/or swaged connections. Pin piles would have a diameter of up to 4.5 m and would be installed using up to a 3,500-kJ hammer to a target penetration depth of up to 90 m below the seabed. A maximum of four OSP pin piles could be installed per day. All impact pile driving activity of pin piles would include a 20-minute soft-start at the beginning of each pile installation; each pin pile would require approximately 2 hours of impact hammering.

Table 7.1.1 Hammer Energy Schedules for Monopile and Jacket Foundations Installed With Impact Hammer Only

WTG Monopile Foundations (9/16-m diameter)			WTG and OSP Jacket Foundations (4.5-m diameter)		
Hammer: NNN 6600			Hammer: MHU 3500S		
Energy Level (kilojoule, kJ)[1]	Strike Count	Pile Penetration Depth (m)	Energy Level (kilojoule, kJ)	Strike Count	Pile Penetration Depth
6,600[a]	2,000	0-10	3,500[a]	1,333	0-20
6,600[b]	2,000	11-21	3,500[b]	1,333	21-41
6,600[c]	3,000	22-35	3,500[c]	1,334	41-60
Total:	7,000	35	Total:	4,000	60

a, b, c – Modeling assumed application of the maximum hammer energy throughout the entire monopile installation. For ease of reference, JASCO used this notation to differentiate progressive stages of installation at the same hammer energy but at different penetration depths and number of hammer strikes.
source: Table 11 in 89 FR 53708

Table 7.1.2 Hammer Energy Schedules for Monopile and Jacket Foundations Installed With Both Vibratory and Impact Hammers

WTG Monopile foundations (9/16-m diameter)					WTG Jacket Foundations (4.5-m diameter)				
Hammers Vibratory HXCV640 Impact NNN6600					Hammers Vibratory SCV640 Impact MHU 3500S				
Hammer type	Energy Level (kilojoule, kJ)	Strike Count	Duration (minutes)	Pile Penetration Depth (m)	Hammer type	Energy Level (kilojoule, kJ)	Strike Count	Duration (minutes)	Pile Penetration Depth (m)
Vibratory	3,500	–	20	0-10	Vibratory	3,500	–	90	0-20
Impact	6,600	2,000	–	11-21	Impact	6,000	1,333	–	21-41
		3,000	–	22-35			1,334	–	42-60
Total:	–	5,000	20	35	–	–	2,667	90	60

a, b, c – Modeling assumed application of the maximum hammer energy throughout the entire monopile installation. For ease of reference, JASCO used this notation to differentiate progressive stages of installation at the same hammer energy but at different penetration depths and number of hammer strikes.
source: Table 12 in 89 FR 53708

SouthCoast is proposing to use noise abatement systems, also known as noise mitigation systems (NMS) or noise attenuation systems (NAS), during all pile driving for the WTG and OSP foundations to reduce the sound pressure levels that are transmitted through the water in an effort to reduce ranges to acoustic thresholds and minimize any acoustic impacts resulting from pile driving. SouthCoast is proposing, and BOEM will require through conditions of COP approval, the use of a noise attenuation system designed to minimize the sound radiated from piles by 10 dB. This requirement will be in place for all foundation piles to be installed and is consistent with the requirements of the proposed MMPA ITA. Consistent with the requirements of the proposed MMPA ITA, the noise mitigation system would be at minimum, a double bubble curtain, and may also include a nearfield sound attenuation device.

Sound field verification (SFV) is required through BOEM’s proposed conditions of COP approval and the proposed MMPA ITA. SFV involves monitoring underwater noise levels during pile driving to determine the actual distances to isopleths of concern (e.g., the distances to the noise levels equated to Level A and Level B harassment for marine mammals and ESA take by harassment and harm (i.e. injury) of sea turtles and Atlantic sturgeon). Requirements will be in place through the MMPA ITA and BOEM's conditions of COP approval to implement adjustments to pile driving and/or additional or alternative sound attenuation measures for subsequent piles if any distances to any thresholds are exceeded. The goal of the SFV and associated requirements is to ensure that the actual distances to isopleths of concern do not exceed those modeled assuming 10 dB of sound attenuation as those are the noise levels/distances that are the foundation of the effects analysis carried out in this Opinion and the exposure analysis and take estimates in the MMPA ITA. Failure to demonstrate that distances to these thresholds of concern as modeled can be met through SFV could lead to the need for reinitiation of this consultation.

Bubbles create a local impedance change that acts as a barrier to sound transmission. The size of the bubbles determines their effective frequency band, with larger bubbles needed for lower frequencies. There are a variety of bubble curtain systems, confined or unconfined bubbles, and some with encapsulated bubbles or panels. Attenuation levels also vary by type of system, frequency band, and location. As described in the conditions of the proposed MMPA ITA, SouthCoast would be required to maintain the following operational parameters for all bubble curtains: The bubble curtains must distribute air bubbles using a target air flow rate of at least 0.5 m^3 /(min*m), and must distribute bubbles around 100 percent of the piling perimeter for the full depth of the water column. In the unforeseen event of a single compressor malfunction, the offshore personnel operating the bubble curtain(s) must adjust the air supply and operating pressure such that the maximum possible sound attenuation performance of the bubble curtain(s) is achieved. The lowest bubble ring must be in contact with the seafloor for the full circumference of the ring, and the weights attached to the bottom ring must ensure 100-percent seafloor contact; no parts of the ring or other objects should prevent full seafloor contact. SouthCoast must require that construction contractors train personnel in the proper balancing of airflow to the bubble ring, and must require that construction contractors submit an inspection/performance report for each deployment. Additionally, a full maintenance check (e.g., manually clearing holes) must occur prior to each pile being installed and corrections to the attenuation device to meet the performance standards must occur prior to impact driving of monopiles. If SouthCoast uses a noise mitigation device in addition to a BBC, similar quality control measures are required.

As described in the BA, in consideration of recent studies (Buehler et al. 2015, Bellmann et al. 2020), BOEM considers an attenuation level of 10 dB achievable using one or more noise attenuation systems. Based on our independent review of the available information, we agree with that determination. It is also consistent with the findings in the MMPA Proposed Rule which notes that recent studies summarizing the effectiveness of noise attenuation systems have shown that broadband sound levels are likely to be reduced by anywhere from 7 to 17 dB, depending on the environment, pile size, and the size, configuration and number of systems used (Buehler *et al.*, 2015; Bellmann *et al.*, 2020). Bellmann et al. (2020) found three noise abatement systems to have proven effectiveness and be offshore suitable: 1) the near-to-pile noise abatement systems - noise mitigation screen (IHC-NMS); 2) the near-to-pile hydro sound damper (HSD); and 3) for a far-from-pile noise abatement system, the single and double big bubble curtain (BBC and dBBC). With the IHC-NMS or the BBC, noise reductions of approximately 15 to 17 dB in depths of 82 to 131 feet (25 to 40 meters) could be achieved. The

HSD system, independent of the water depth, demonstrated noise reductions of 10 dB with an optimum system design. The achieved broadband noise reduction with a BBC or dBBC was dependent on the technical-constructive system configuration. *In situ* measurements during installation of large monopiles (approximately 8 m) for more than 150 WTGs in comparable water depths (greater than 25 m) and conditions in Europe indicate that attenuation levels of 10 dB are readily achieved (Bellmann, 2019; Bellmann *et al.*, 2020) using single BBCs as a noise abatement system.

We have also considered information from sound field verification reports submitted for offshore wind construction along the U.S. Atlantic Coast. The Coastal Virginia Offshore Wind (CVOW) pilot project systematically measured noise resulting from the impact driven installation of two 7.8 m monopiles, one with a noise abatement system (double big bubble curtain (dBBC)) and one without (Amaral et al. 2021, see also Dies et al. 2024). Although many factors contributed to variability in received levels throughout the installation of the piles (e.g., hammer energy, technical challenges during operation of the dBBC), reduction in broadband SEL using the dBBC (comparing measurements derived from the mitigated and the unmitigated monopiles) ranged from approximately 9 to 15 dB. The effectiveness of the dBBC as a noise mitigation measure was found to be frequency dependent, reaching a maximum around 1 kHz; this finding is consistent with other studies (*e.g*., Bellman, 2014; Bellman *et al*., 2020).

As of the writing of this Opinion, we have received sound field verification reports for a number of piles installed for the South Fork, CVOW Commercial, Vineyard Wind 1, and Revolution Wind projects. We note that South Fork, Vineyard Wind 1, and Revolution Wind deployed a double bubble curtain and a near field noise attenuation device and carried out impact pile driving only while CVOW deployed a double big bubble curtain without being paired with another noise attenuation device and carried out vibratory pile setting and impact pile driving. Together, these results indicate that the required sound attenuation systems are capable of reducing noise levels to the distances predicted by modeling assuming 10 dB attenuation when properly and effectively deployed and when maintenance is carried out between deployments to optimize effectiveness.

As described in Section 3.0 *Description of the Proposed Action* of this Opinion, in addition to seasonal restrictions on impact pile driving and requirements for use of a noise attenuation system, there are a number of other measures included as part of the proposed action that are designed to avoid or minimize exposure of ESA listed species to underwater noise. These measures are discussed in detail in the effects analysis below but generally include requirements for implementing clearance and shutdown requirements and ensuring adequate visibility for monitoring.

SouthCoast may submit a nighttime monitoring plan that would be reviewed by BOEM, BSEE, NMFS OPR, and NMFS GARFO. Unless and until this plan is approved, proposed conditions of COP approval and the MMPA ITR would only allow pile driving that is initiated no more than 1 hour before civil sunrise and no later than 1.5 hours before civil sunset. These time of day restrictions are to ensure that there is adequate daylight to allow for PSOs to visually monitor the clearance and shutdown zones. Pile driving could be initiated outside of this window only if SouthCoast can demonstrate through a nighttime monitoring plan that their planned set up of night vision devices (e.g., mounted thermal/IR camera systems, hand-held or wearable night vision devices (NVDs), infrared (IR) spotlights) are able to reliably detect sea turtles and marine mammals to the full extent of the established clearance and shutdown zones. If the plan does not include a full description of the proposed technology, monitoring methodology, and data supporting a determination that sea turtles and marine mammals can be reliably and effectively detected within the clearance and shutdown zones before and during pile driving and in consideration of the required minimum visibility zones, then initiation of pile driving after dark will not be allowed. The monitoring plan will also need to identify the efficacy of the technology at detecting sea turtles and marine mammals in the clearance and shutdowns under all the various conditions anticipated during construction, including varying weather conditions, sea states, and in consideration of the use of artificial lighting. The proposed conditions of COP approval and the MMPA ITA require both BOEM and NMFS approval of the plan before any pile driving could be carried out outside the time of day requirements outlined here.

Based on the requirements that the monitoring plan will need to demonstrate the ability to detect sea turtles and large whales to the full extent of the established clearance and shutdown zones, it will need to demonstrate an ability for visual PSOs to reliably detect sea turtles at a distance of 200 m from the pile to be installed and for visual PSOs to reliably detect large whales throughout the minimum visibility zones (which ranges from 2.3 to 7.4 km depending on location, time of year, and type of pile being installed). We note that BOEM's reduction of the size of the clearance and shutdown zones for sea turtles from 500 m (as described in their BA and then modified during the consultation period) to 200 m is a result of consideration of information presented in other lessee's draft night time monitoring plans which supports a determination that it is likely impracticable to reliably detect sea turtles beyond 200 m at night. This is largely due to sea turtles being cold blooded and therefore, infrared and other heat detecting technologies that can aid in visualization of marine mammals after dark, being largely ineffective for sea turtles. Based on our review of the best available information we have determined that 200 m is the maximum distance that can be effectively monitored at nighttime for listed sea turtles based on existing technology.

Modeling was carried out to predict sound fields and exposure of ESA listed species to noise during the pile driving scenarios considered as part of the proposed action; this is considered in the species specific sections that follow.

UXO Detonations

As described in Section 3.0 *Description of the Proposed Action*, the proposed action includes the detonation in place of up to 10 UXOs with up to 454-kg (1,000 pounds) charges, which as described by BOEM in the BA is the largest charge that is reasonably expected to be present. As described by BOEM, SouthCoast Wind, and NMFS OPR, while the specific charges of all 10 UXOs are unknown, it is reasonable to expect that all 10 could consist of this 454 kg charge. During the consultation period, SouthCoast revised their proposed time of year restriction such that UXO detonations would only be planned between June 1 (as opposed to May 1 as addressed in the Proposed Rule and BA) and November 30. As such, any detonations would occur on up to 10 different days (*i.e.*, only one detonation would occur per day) during daylight hours between June 1 and November 30. We note that no more than 5 detonations are expected to occur in a single year, with detonations occurring over two years.

The BA and Proposed Rule present the results of modeling of acoustic fields for UXO detonations (Hannay and Zykov 2022), which included three sound pressure metrics (peak pressure level, SEL, and acoustic impulse). Four charge weights (2.3 kg to 454 kg) were modeled at five different locations and associated depths located within the Lease Area and cable corridors (ECC). Two sites are located in the Lease Area, S1 (60 m depth), and S2 (45 m depth). Three sites are located within the ECCs, one along the western ECC (S3, 30 m) and two along the eastern ECC (S4, 20m); S5, 10 m)). Sites 1 and 2 were determined to be representative of the Lease Area and Sites 3-5 were deemed representative of the ECCs where detonations could occur (see Figure 1 in Hannay and Zykov, 2022). The modeling of acoustic fields was performed using a combination of semi-empirical and physics-based computational models; this is described in the taxa-specific analyses below. The modeling assumed that the full weights of UXO explosive charges are detonated together with their donor charges and that no shielding by sediments occurs. Modeling also reflected that only one UXO would be detonated within a 24-hour period. Modeling of mitigated (10 dB attenuation) and unmitigated detonations were conducted; however, mitigation will be required for all detonation events (10 dB attenuation will be required as a condition of COP approval and the proposed MMPA ITA) therefore only those results are considered here.

SouthCoast is committing to use of a dual noise-mitigation system during all detonations. This is also a condition proposed by BOEM and NMFS OPR. Based on the available literature, 10 dB minimum of attenuation is possible with the use of a noise mitigation system (review provided in Hannay and Zykov 2022), and SouthCoast Wind has committed to attaining 10 dB attenuation for all UXO detonation events. As described in Section 3.0 *Description of the Proposed Action* of this Opinion, in addition to seasonal and time of day restrictions as well as requirements for use of a noise attenuation system, there are a number of other measures included as part of the proposed action that are designed to avoid or minimize exposure of ESA listed species to UXO detonations, including clearance and shutdown requirements. These are discussed in detail in the Effects Analysis below.

Vessel Noise

Vessel noise is considered a continuous noise source that will occur intermittently. Vessels transmit noise through water primarily through propeller cavitation, although other ancillary noises may be produced. The intensity of noise from vessels is roughly related to ship size and speed. Large ships tend to be noisier than small ones, and ships underway with a full load (or towing or pushing a load) produce more noise than unladen vessels. Radiated noise from ships varies depending on the nature, size, and speed of the ship. McKenna et al. (2012b) determined that container ships produced broadband source levels around 177 to 188 dB re 1 µPa and a typical fishing vessel radiates noise at a source level of about 158 dB re 1 µPa (Mintz and Filadelfo 2011; Richardson et al. 1995b; Urick 1983). Noise levels generated by larger construction and installation and O&M would have an approximate *L*rms source level of 170 dB re 1 µPa-m (Denes et al. 2020). Smaller construction and installation and O&M vessels, such as CTVs, are expected to have source levels of approximately 160 dB re 1 µPa-m, based on observed noise levels generated by working commercial vessels of similar size and class (Kipple and Gabriele 2003; Takahashi et al. 2019).

Typical large vessel ship-radiated noise is dominated by tonals related to blade and shaft sources at frequencies below about 50 Hz and by broadband components related to cavitation and flow noise at higher frequencies (approximately around the one-third octave band centered at 100 Hz) (Mintz and Filadelfo 2011; Richardson et al. 1995b; Urick 1983). The acoustic signature produced by a vessel varies based on the type of vessel (e.g., tanker, bulk carrier, tug, container ship) and vessel characteristics (e.g., engine specifications, propeller dimensions and number, length, draft, hull shape, gross tonnage, speed). Bulk carrier noise is predominantly near 100 Hz while container ship and tanker noise is predominantly below 40 Hz (McKenna et al. 2012b). Small craft types will emit higher-frequency noise (between 1 kHz and 50 kHz) than larger ships (below 1 kHz). Large shipping vessels and tankers produce lower frequency noise with a primary energy near 40 Hz and underwater SLs for these commercial vessels generally range from 177 to 188 decibels referenced to 1 micropascal at 1 meter (dB re 1 µPa m) (McKenna et al., 2012). Smaller vessels typically produce higher frequency sound (1,000 to 5,000 Hz) at SLs of 150 to 180 dB re 1 µPa m (Kipple and Gabriele, 2003; Kipple and Gabriele, 2004).

As part of various construction related activities, including cable laying and construction material delivery, dynamic positioning thrusters may be utilized to hold vessels in position or move slowly. Sound produced through use of dynamic positioning thrusters is similar to that produced by transiting vessels, and dynamic positioning thrusters are typically operated either in a similarly predictable manner or used for short durations around stationary activities. Dynamically positioned (DP) vessels use thrusters to maneuver and maintain station, and generate substantial underwater noise with apparent SLs ranging from SPL 150 to 180 dB re 1 µPa depending on operations and thruster use (BOEM 2014, McPherson et al., 2016). Acoustic propagation modeling calculations for DP vessel operations were completed by JASCO Applied Sciences, Inc. for two representative locations for pile foundation construction at the South Fork Wind Farm SFWF based on a 107 m DP vessel equipped with six thrusters (Denes et al., 2021a). Unweighted root-mean square sound pressure levels (SPLrms) ranged from 166 dB re one µPa at 50 m from the vessel (CSA 2021). Noise from vessels used for the SouthCoast project are expected to be similar in frequency and source level.

Cable Installation

Noise produced during cable laying includes dynamic positioning (DP) thruster use. Nedwell et al. (2003) reports a sound source level for cable trenching operations in the marine environment of 178 dB re 1µPa at a distance of 1m from the source. Hale (2018) reports on unpublished information for cable jetting operations indicating a comparable sound source level, concentrated in the frequency range of 1 kHz to 15 kHz and notes that the sounds of cable burial were attributed to cavitation bubbles as the water jets passed through the leading edge of the burial plow.

WTG Operations

As described in BOEM's BA, once operational, offshore wind turbines produce continuous, non-impulsive underwater noise, primarily in the lower-frequency bands (below 1 kHz; Thomsen et al. 2006); vibrations from the WTG drivetrain and power generator would be transmitted into the steel monopile foundation generating underwater noise. Most of the currently available information on operational noise from turbines is based on monitoring of existing windfarms in Europe. Although useful for characterizing the general range of WTG operational noise effects, much of this information is drawn from studies of older generation WTGs that operate with gearboxes and is not necessarily representative of current generation direct-drive systems (Elliot et al. 2019; Tougaard et al. 2020). Studies indicate that the typical noise levels produced by older-generation WTGs with gearboxes range from 110 to 130 dB RMS with 1/3-octave bands in the 12.5- to 500-Hz range, sometimes louder under extreme operating conditions such as higher wind conditions (Betke et al. 2004; Jansen and de Jong 2016; Madsen et al. 2006; Marmo et al. 2013; Nedwell and Howell 2004; Tougaard et al. 2009). Recent publications have provided more information on operational noise including from larger, direct drive turbines (HDR 2023, Bellman et al. 2023, Holme et al. 2023). Consistently, the available scientific literature concludes that, regardless of turbine or foundation type, operational noise increases concurrently with ambient noise (from wind and waves), meaning that noise levels usually remain indistinguishable from background within a short distance from the source under typical operating conditions.

Tougaard et al. (2020) concluded that operational noise from multiple WTGs could elevate noise levels within a few kilometers of large windfarm operations under very low ambient noise conditions. Tougaard et al. (2020) caution that their analysis is based on monitoring data for older generation WTG designs that are not necessarily representative of the noise levels produced by modern direct-drive systems, which are considerably quieter. However, even with these louder systems, Tougaard further stated that the operational noise produced from WTGs is static in nature and is lower than noise produced from passing ships; operational noise levels are likely lower than those ambient levels already present in active shipping lanes, meaning that any operational noise levels would likely only be detected at a very close proximity to the WTG (Thomsen et al., 2006; Tougaard et al., 2020).

Stober and Thomsen (2021) summarized data on operational noise from offshore wind farms with 0.45 – 6.15 MW turbines based on published measurements and simulations from gray literature then used modeling to predict underwater operational noise levels associated with a theoretical 10 MW turbine. Using generic transmission loss calculations, they then predicted distances to various noise levels including 120 dB re 1uPa RMS. The authors note that there is unresolved uncertainty in their methods because the measurements were carried out at different water depths and using different methods that might have an effect on the recorded sound levels. Given this uncertainty, it is questionable how reliably this model predicts actual underwater noise levels for any operating wind turbines. The authors did not do any in-field measurements to validate their predictions. Additionally, the authors noted that all impact ranges (i.e., the predicted distance to thresholds) come with very high uncertainties. Using this methodology, they used the sound levels reported for the Block Island Wind Farm turbines in Elliot et al. 2019 and estimated the noise that would be produced by a theoretical 10 MW direct-drive WTG would be above the 120 dB re 1uPa RMS at a distance of up to 1.4 km from the turbine. However, it is important to note that this desktop calculation, using values reported from different windfarms under different conditions, is not based on in situ evaluation of underwater noise of a 10 MW direct-drive turbine. Further, we note that context is critical to the reported noise levels evaluated in this study as well as for any resulting predictions. Without information on soundscape, water depth, sediment type, wind speed, and other factors, it is not possible to determine the reliability of any predictions from the Stober and Thomsen paper to the SouthCoast Wind project (up to 15 MW direct drive turbines expected) or any other 10 MW turbine. Further, as noted by Tougaard et al. (2020), as the turbines also become higher with larger capacity (i.e. they are further above the water), the distance from the noise source in the nacelle to the water becomes larger too, and with the mechanical resonances of the tower and foundation likely to change with size as well, it is not straightforward to predict changes to the noise with increasing sizes of the turbines. Comparison of in-situ measurements of operational noise to predicted outcomes from these models (see Bellman et al. 2023, Holme et al. 2023, both described further below), indicates that the modeling significantly overestimates actually measured operational noise of turbines. Therefore, Stober and Thomsen (2021) is not considered the best available scientific information for estimating operational noise levels of the SouthCoast turbines. We also note that Tougaard et al. (2020) and Stober and Thomsen (2021) both note that operational noise is less than shipping (i.e., vessel) noise; this suggests that in areas with consistent vessel traffic, such as the SouthCoast lease area, operational noise may not be detectable above ambient noise.

Elliot et al. (2019)[34] summarized findings from hydroacoustic monitoring of operational noise from the Block Island Wind Farm (BIWF). The BIWF is composed of five GE Haliade 150 6-MW direct-drive WTGs on jacketed foundations located approximately 80 km northwest of the western edge of the SouthCoast lease. We note that Tougaard (2020) reported that in situ assessments have not revealed any systematic differences between noise from turbines with different foundation types (Madsen et al., 2006); this is consistent with findings reported in Bellman et al. 2023. However, we note that HDR 2023 (see below) found differences in operational noise from the BIWF and CVOW turbines that could be related to differences in foundation types. Thus, the extent to which foundation types may influence underwater noise from operations is at least partially unresolved. However, we note that, across foundation types, underwater operational noise levels are largely consistent and that most studies have not found meaningful differences in underwater operational noise across foundation types.

For the BIWF, underwater noise monitoring took place from December 20, 2016 – January 7, 2017 and July 15 – November 3, 2017. Elliot et al. (2019) also presents measurements comparing underwater noise associated with operations of the direct-drive turbines at the BIWF to underwater noise reported at wind farms in Europe using older WTGs with gearboxes and conclude that absent the noise from the gears, the direct-drive models are quieter. Elliot et al. (2019) presented a representative high operational noise scenario at an observed wind speed of 15 m/s (approximately 54 km/h, which is 1.5 to three times the average annual wind speed in the SouthCoast WFA (COP Appendix X), which is summarized in Table 7.1.3 below. As shown, the BIWF WTGs produced frequency weighted instantaneous noise levels of 103 and 79 dB SEL for the LFC and MFC marine mammal hearing groups in the 10-Hz to 8-kHz frequency band, respectively. Frequency weighted noise levels for the LFC and MFC hearing groups were higher for the 10-Hz to 20-kHz frequency band at 122.5- and 123.3-dB SEL, respectively.

Table 7.1.3. Frequency weighted underwater noise levels, based on NMFS 2018, at 50 m from an operational 6-MW WTG at the Block Island Wind Farm.

[34] Also cited elsewhere as HDR 2019 or BOEM OCS Study 2019-028. Available online at: https://espis.boem.gov/final%20reports/BOEM_2019-028.pdf

Species Hearing Group	Instantaneous dB SEL*		Cumulative dB SEL†	
	10 Hz to 8 kHz	10 Hz to 20 kHz	10 Hz to 8 kHz	10 Hz to 20 kHz
Unweighted	121.2	127.1	170.6	176.5
LFC (North Atlantic right whale, fin whale, sei whale)	103.0	122.5	152.4	171.9
MFC (sperm whale)	79.0	123.3	128.4	172.7

Source: Elliot et al. (2019)

* 1-second SEL re 1 µPaS2 at 15 m/s (33 mph) wind speed. 1sec SEL = RMS

† Cumulative SEL re 1 µPaS2 assuming continuous 24 exposure at 50 m from WTG foundation operating at 15 m/s.

Elliot et al. (2019) also summarizes sound levels sampled over the full survey duration. These averages used data sampled between 10 PM and 10 AM each day to reduce the risk of sound contamination from passing vessels. The loudest noise recorded was 126 dB re 1uPa at 50 m from the turbine when wind speeds exceeded 56 km/h; at wind speeds of 43.2 km/h and less, measured noise did not exceed 120 dB re 1uPa at 50 m from the turbine. As summarized in the COP Appendix X, average wind speeds in the lease area (based on a 10-year query of historical weather data from NOAA Nantucket Shoals Monitoring Station 44008), at 10 m elevation is 14 knots (7.2 m/s or 25.9 km/h). The maximum observed wind speed from 2007 to 2017 occurred during Extratropical storm Noel in November 2007 (94.27 km/h or 50.9 knots). A recent query of the data indicates wind speed exceeding 43 km/h 9% of the time during 2023 and wind speed exceeding 56 km/h 1% of the time during 2023. Similar results were observed in 2022 and 2021 (all data available at: https://www.ndbc.noaa.gov/histsearch.php?station=44008).

Table 7.1.4. Summary of unweighted SPL RMS average sound levels (10 Hz to 8 kHz) measured at 50 m (164 ft.) from WTG 5.

Wind speed (Km/h)	Overall average sound level, dB re 1 µPa
7.2	112.2
14.4	113.1
21.6	114
28.8	115.1
36	116.7
43.2	119.5
46.8	120.6
Average over survey duration	119
Background sound levels in calm conditions	107.4 [30 km from turbine]
	110.2 [50 m from turbine]

Reproduced from Elliot et al. (2019); wind speeds reported as m/s converted to km/h for ease of reference

Underwater acoustic monitoring was conducted under BOEM's Real-Time Opportunity for Development Environmental Observations (RODEO) Program after CVOW's two turbines became operational off the coast of Virginia (HDR 2023). As described in the report, the objective of the monitoring was to measure and analyze underwater sound levels within the water column and seafloor sediment vibrations generated by the operating monopile turbines. The two operating WTGs are Siemens Gamesa's 6 MW SWT-6.0-154 direct drive turbines with 154 m rotors installed on 7.8 m diameter monopile foundations. Underwater noise data were collected using one Geosled and two Ocean Bottom Seismometers; one RBRconcerto conductivity, temperature, and depth logger was also deployed approximately 1.3 km from Turbine A01 and 352 meters (m) from Turbine A02. The unattended systems collected data over approximately 40 days from December 13, 2021 to January 24, 2022 (HDR 2023). Analyses of operational phase underwater acoustic monitoring data indicated that noise levels recorded during turbine operations ranged from 120 to 130 dB re 1 µPa except during storms, when the received levels increased to 145 dB re 1 µPa. Recorded particle acceleration levels were compared to published behavioral audiograms of selected fish species and were found to be below the respective hearing thresholds for these species. Additionally, all recorded measurements were below the NMFS criteria for TTS and PTS for marine mammals. Results also indicated that operational phase sound levels recorded at CVOW were higher (10 to 30 dB) than those previously recorded at the BIWF at frequencies below approximately 120 Hz. At frequencies above 120 Hz, CVOW operational phase monitoring results were broadly consistent with operational phase acoustic monitoring previously conducted at BIWF and wind farms in Europe. The report indicates that these differences may be attributable to the differences in foundation types and the vibrations in the monopile structures but that this requires further investigation (monopiles at CVOW, lattice jacket at BIWF); we also note that while the WTGs at both projects are 6 MW direct drive turbines they have different manufacturers. (HDR 2023).

Holme et al. 2023 examined underwater noise measurements recorded within and outside operating offshore wind farms consisting of 6.3 MW (direct-drive) and 8.3 MW (planetary gear) turbines, considering data collected over a 5 week period from multiple hydrophones located between 70 m and 5 km from operating WTGs. All three wind projects (Gode Wind 1 and 2, Borkum Riffgrund 2, all in the North Sea, Germany) monitored have depths of approximately 30 m. Data were collected to facilitate a statistical examination of how the magnitude of underwater noise changes with turbine activity (power production data) and natural fluctuations (e.g., tides and wind). Additionally, the authors compared recorded noise levels to simulated noise levels from a published empirical model (Tougaard et al. 2020, Stober and Thomsen 2021, both described above), showing that the model's extrapolated noise levels greatly exceeded that of the in-situ recordings. The data reported by Holme et al. showed no noticeable differences on the broadband SPL between the two foundation types assessed in the study (monopiles and suction bucket jackets). The authors found no changes to the ambient broadband SPL from either 6.3 or 8.3 MW operating wind turbines. While this partly was attributed to the high ambient noise levels of the German Bight, the authors concluded that natural effects (e.g., wind speed and tidal changes) were the dominating forces behind changes to the ambient noise levels.

Bellman et al. 2023 evaluated data from all German offshore wind farms included in the MarinEARS database (MarinEARS - Marine Explorer and Registry of Sound; specialist information system for underwater noise and national noise registry for noise events (continuous and impulsive noise) in the German EEZ of the North- and Baltic Sea to the EU in accordance with the MSFD (https://marinears.bsh.de). This database includes data for 27 operational and 12 background noise measurements in 24 wind farms with 16 different WTG-types from seven different manufacturers and nominal power between 2.3 and 8.0 MW, installed on five different foundation structures; there were three measurement positions per wind farm, each with three defined operating states of the turbines. The authors concluded that the evaluation of noise conditions during the operation of offshore wind farms inside and outside wind farms is extremely complex, as noise input from wind turbines in operation and from wind farm-related service traffic do not differ significantly in time or space from background noise already present in the surroundings. Specific findings include: Noise input from operating offshore wind turbines is basically characterized by low frequencies; these low-frequency noise inputs into the water are only dominating the broadband Sound Pressure Level in the immediate vicinity of the turbines (~ 100 m) and when the turbines are operating close to their nominal power. The mean (broadband) total Sound Pressure Level (SPL50 or L50) at nominal power of the turbines varies between 112 and 131 dB (median and mean value 120 dB). The mean Sound Pressure Level (L50) from the 1/3-octave-band with the dominant component of the natural frequency of the system varies between 102 and 126 dB (median and mean value 114 dB); no evaluation-relevant differences based on water depths (20 to 40 m); The natural frequencies of the turbines tend to be lower-frequency (≤ 80 Hz) for direct-drive resp. gearless turbines and are also "quieter" than turbines with gearboxes; and, a significant correlation between the noise and foundation structure could not be determined.

Importantly, the authors concluded that a strong correlation between the noise inputs and the nominal power of the turbines (between 2.3 and 8.0 MW) could not be found. They noted turbines with a higher nominal power to be slightly quieter than turbines with a lower nominal power (on average ≤ 5 MW 122.8 dB, > 5 MW 120.0 dB); however, they note that this may also be due to larger, newer turbines mostly being direct drive rather than gearbox. The tonal, low-frequency components of the turbines in operation can usually still be measured outside the wind farms up to distances of a few kilometers, but with increasing distance, they mix with the general background noise level, so that the emitted noise is no longer dominating the broadband Sound Pressure Level (signal-to noise-ratio < 6 dB). The authors conclude that low-frequency noise input from the wind turbine is no longer audible to individual marine mammals at distances of 100 m from the turbine. The background noise level outside the wind farms is mostly dominated by non-wind farm-related shipping traffic outside the wind farms and varies strongly in different directions to a wind farm (Bellman et al. 2023).

Like Holme et al. (2023), Bellman et al. (2023) evaluated in-situ measurements in comparison to the predictions made by modeling approaches (Tougaard et al. 2020, Stober and Thomsen 2021). Consistent with the findings of Holme et al. 2023, the authors concluded that these modeled predictions lead to considerable overestimations of the actually measured operational noise of turbines of up to 8 dB and that other modeling components could not be validated.

BOEM indicates that the WTGs proposed for SouthCoast are expected to use the newer, direct-drive technology. The results from the available in-situ operational noise measurements (Elliot et al. 2019, HDR 2023, Holme 2023, Bellman et al. 2023) all have consistent findings across a range of turbine sizes, geographic areas, water depths, and foundation types. As such, and given the issues with modeled predictions outlined above including the findings of Bellman et al. 2023 and Holme 2023 that the modeled predictions significantly overestimate underwater noise from operational turbines, we consider the published in-situ measurements cited herein to represent the best available data on operational noise that can be expected from the operation of the SouthCoast turbines. We acknowledge that as the SouthCoast turbines will likely have a greater capacity than the turbines reported in these papers there is some uncertainty in operational noise levels. However, we note that Bellman et al. (2023) did not identify a strong correlation between noise and the nominal power of the turbines (between 2.3 and 8.0 MW) and that even the papers that predict greater operational noise note that operational noise is less than shipping noise. In consideration of the literature cited here, we find that the best available information indicates that operational noise will typically be 130 dB or less and be detectable above ambient by any listed species at only short distances from any foundation (less than 100 m).

High-Resolution Geophysical Surveys
As part of the proposed action for consultation in this opinion described in Section 3.0 *Description of the Proposed Action*, SouthCoast plans to conduct HRG surveys in the WDA, including along the export cable routes to landfall locations intermittently over the life of the project. Equipment planned for use includes multibeam echosounders, side scan sonars, shallow penetration sub-bottom profilers (SBPs) (*e.g.*, parametric Compressed High-Intensity Radiated Pulses (CHIRP) SBPs and non-parametric SBP), medium penetration sub-bottom profilers (*e.g.*, sparkers and boomers), and ultra-short baseline positioning equipment.

As described in the MMPA Proposed Rule, over the five-year duration of the LOA, HRG survey effort will be variable across the five-year period, with surveys planned for either up to 75 or 112.5 days/year. HRG surveys will be conducted using up to four vessels. On average, 80-line km (49.7-mi) will be surveyed per vessel each survey day at approximately 5.6 km/hour (3 knots) on a 24-hour basis although some vessels may only operate during daylight hours (~12-hour survey vessels). During the 2-years when foundations are being installed, an estimated 4,000 km (2,485 mi) may be surveyed within the Lease Area and 5,000 km (3,106 mi) along the ECCs in water depth ranging from 2 m (6.5 ft) to 62 m (204 ft). On average, 80-line km (49.7-mi) will be surveyed per vessel each survey day at approximately 5.6 km/hour (3 knots) on a 24-hour basis although some vessels may only operate during daylight hours (~12-hour survey vessels). During years when foundation installation is not planned, (3 of the 5 years within the effective period of the proposed ITR), SouthCoast would survey an estimated 2,800 km (1,7398 mi) in the Lease Area and 3,200 km (1,988.4 mi) along the ECCs each year for three years (n=18,000 km total). After this five-year period, surveys will be more intermittent and carried out to survey foundations, scour, and scour protection, and cable burial; as described in the BA, HRG surveys are anticipated to occur intermittently over the life of the project.

As noted in Section 3.5, BOEM has completed a programmatic ESA consultation with NMFS for HRG surveys and other types of survey and monitoring activities supporting offshore wind energy development (NMFS 2021a; Appendix C to this Opinion). The equipment proposed for the SouthCoast HRG surveys is consistent with the survey equipment considered in that programmatic consultation. A number of measures to minimize effects to ESA listed species during HRG operations are required by BOEM as conditions of COP approval and by NMFS

OPR as conditions of the MMPA ITA (see Section 3.0 *Description of the Proposed Action* and Appendix A-D). Through conditions of COP approval, BOEM will require SouthCoast to comply with all relevant programmatic survey and monitoring PDCs and BMPs included in the 2021 programmatic ESA consultation; these measures are detailed in Appendix B of the programmatic consultation. HRG surveys related to the approval of the SouthCoast COP are considered part of the proposed action evaluated in this Opinion and the applicable survey and monitoring PDCs and BMPs included in the 2021 programmatic ESA consultation are incorporated by reference. They are thus also considered components of the proposed action evaluated in this Opinion.

All noise producing survey equipment is secured to the survey vessel or towed behind a survey vessel and is only turned on when the vessel is traveling along survey transects; thus, the area ensonified is constantly moving, making survey noise transient and intermittent. The information on these noise sources (Table 7.1.5) is consistent with the information and effects analysis contained in the above referenced programmatic consultation. Anticipated distances from the HRG sound sources to noise thresholds of concern are presented in the species-specific analyses below.

Consistent with conclusions made by BOEM, and by NMFS OPR in the MMPA Proposed Rule operation of some survey equipment types is not reasonably expected to result in any effects to ESA listed species in the area. Parametric sub-bottom profilers (SBP), also called sediment echosounders, generate short, very narrow-beam (1° to 3.5°) signals at high frequencies (generally around 85-100 kHz). The narrow beamwidth significantly reduces the potential that an individual animal could be exposed to the signal, while the high frequency of operation means that the signal is rapidly attenuated in seawater. Ultra-Short Baseline (USBL) positioning systems produce extremely small acoustic propagation distances in their typical operating configuration. The single beam and Multibeam Echosounders (MBES), side-scan sonar, and the magnetometer/gradiometer that may be used in these surveys all have operating frequencies >180 kHz and are therefore outside the general hearing range of ESA listed species that may occur in the survey area. This is consistent with the conclusions made in the above referenced programmatic consultation.

Table 7.1.5 identifies all the representative survey equipment that operate below 180 kilohertz (kHz) (*i.e.,* at frequencies that may be audible to the different ESA listed species in the action area) that is proposed for use in planned geophysical survey activities. Equipment with operating frequencies above 180 kHz (*e.g.*, SSS, MBES) and equipment that does not have an acoustic output (*e.g.,* magnetometers) will also be used but are not discussed further because they are outside the general hearing range of ESA listed species in the action area or do not produce noise and thus will have no effect on such species.

Table 7.1.5 Summary of Representative HRG Survey Equipment and Operating Parameters

Equipment Type	Representative Model	Operating Frequency (kHz)	Source Level SPL_{rms} (dB)	Source $Level_{0\text{-}pk}$ (dB)	Pulse Duration (ms)	Repetition Rate (Hz)	Beamwidth (degrees)	Information Source

Sub-bottom Profiler	EdgeTech 3100 with SB 2-16[1] towfish	2 – 16	179	184	10	9.1	51	CF
	EdgeTech DW-106[1]	1 – 6	176	183	14.4	10	66	CF
	Knudson Pinger[2]	15	180	187	4	2	71	CF
	Teledyn Benthos CHIRP III - TTV 170[3]	2 – 7	199	204	10	14.4	82	CF
Sparker[4]	Applied Acoustics Dura-Spark UHD (400 tips, 800 J)	0.01 – 1.9	206	213	3.4	2	Omni	CF
	Geomarine Geo-Spark (400 tips, 800 J)	0.01 – 1.9	206	213	3.4	2	Omni	CF
Boomer	Applied Acoustics triple plate S-Boom (700–1,000 J)	0.1 – 5	205	211	0.9	3	61	CF

Note: J = joule; kHz = kilohertz; dB = decibels; SL = source level; UHD = ultra-high definition; rms = root-mean square; µPa = microPascals; re = referenced to; SPL = sound pressure level; PK = zero-to-peak pressure level; Omni = omnidirectional source; CF = Crocker and Fratantonio (2016)

1 – The EdgeTech Chirp 512i measurements and specifications provided by Crocker and Fratantonio (2016) were used as a proxy for the Edgetech 3100 with SB-216 towfish and EdgeTech DW-106.

2 – The EdgeTech Chirp 424 as a proxy for source levels as the Chirp 424 has similar operation settings as the Knudsen Pinger SBP.

3 – The Knudsen 3202 Echosounder measurements and specifications provided by Crocker and Fratantonio (2016) were used as a proxy for the Teledyne Benthos Chirp III TTV 170.

4 – In the proposed rule, the SIG ELC 820 Sparker, 5 m source depth, 750 J setting was used a proxy for both the Applied Acoustics Dura-Spark UHD (400 tips, 800 J) and Geomarine Geo-Spark (400 tips, 800 J). Following review of public comments, NMFS OPR NMFS requested that exposures/takes incidental to high-resolution geophysical (HRG) surveys be re-evaluated. Specifically, NMFS requested that SouthCoast Wind use measurements of the Applied Acoustics (AA) Dura-Spark sparker reported by Crocker and Fratantonio (2016) as a proxy for the GeoMarine GeoSpark and AA Dura-Spark UHD, rather than the SIG ELC 820 sparker that was used in the ITR Application, because NMFS believes the AA Dura-Spark is more similar to these instruments in terms of source characteristics. Scaling the source level given in Crocker and Fratantonio (2016) by electrical energy and using a 1-m tow depth, which may be more appropriate given that the instrument is likely to be towed near the surface, NMFS estimated the source level of the AA Dura-Spark to be 206 dB, rather than the 203 dB source level for the SIG ELC 820 sparker used in the ITR Application. The updated source level is included here.

source: Table 3 in 89 FR 53708

The boomer and sparker, as well as some of the sub-bottom profilers, operate at a frequency that is detectable by the ESA listed whales, sea turtles, and Atlantic sturgeon in the action area. Assessments of exposure by these species to the noise sources is addressed in the species group sections below.

7.1.3 Effects of Project Noise on ESA-Listed Whales

Background Information – Acoustics and Whales

The *Notice of Proposed Incidental Take Regulations for the Taking of Marine Mammals Incidental to the SouthCoast Offshore Wind Project* (89 FR 53708; June 27, 2024, "Proposed Rule") presents extensive information on the potential effects of underwater sound on marine mammals; that information is the best scientific information available on the effects of underwater sound on marine mammals. Rather than repeat that information, that information is incorporated by reference here. As explained in detail in the MMPA Proposed Rule, anthropogenic sounds cover a broad range of frequencies and sound levels and can have a range of highly variable impacts on marine life, from none or minor to potentially severe behavioral responses, depending on received levels, duration of exposure, behavioral context, and various other factors. Underwater sound from active acoustic sources can have one or more of the following effects: temporary or permanent hearing impairment, non-auditory physical or physiological effects (including injury), behavioral disturbance, stress, and masking (Richardson et al., 1995; Gordon et al., 2004; Nowacek et al., 2007; Southall et al., 2008; Götz et al., 2009). The degree of effect is intrinsically related to the signal characteristics, received level, distance from the source, and duration of the sound exposure. In general, sudden, high level sounds can cause hearing loss, as can longer exposures to lower level sounds. Temporary or permanent loss of hearing (i.e. temporary (TTS) or permanent threshold shift (PTS) respectively) will occur almost exclusively for noise within an animal's hearing range.

Richardson et al. (1995) described zones of increasing intensity of effect that might be expected to occur, in relation to distance from a source and assuming that the signal is within an animal's hearing range. First is the area within which the acoustic signal would be audible (potentially perceived) to the animal but not strong enough to elicit any overt behavioral or physiological response. The next zone corresponds with the area where the signal is audible to the animal and of sufficient intensity to elicit behavioral or physiological responsiveness. Third is a zone within which, for signals of high intensity, the received level is sufficient to potentially cause discomfort or tissue damage to auditory or other systems. Overlaying these zones to a certain extent is the area within which masking may occur. Masking occurs when the receipt of a sound is interfered with by another coincident sound at similar frequencies and at similar or higher intensity, and may occur whether the sound is natural (e.g., snapping shrimp, wind, waves, precipitation) or anthropogenic (e.g., shipping, sonar, seismic exploration) in origin. Masking is when a sound interferes with or masks the ability of an animal to detect a signal of interest that is above the absolute hearing threshold. The masking zone may be highly variable in size. Masking can lead to behavioral changes in an attempt to compensate for noise levels or because sounds that would typically have triggered a behavior were not detected.

In general, the expected responses to pile driving noise may include threshold shift, behavioral effects, stress response, and auditory masking. Threshold shift is the loss of hearing sensitivity at certain frequency ranges (Finneran 2015). It can be permanent (PTS), in which case the loss of hearing sensitivity is not fully recoverable, or temporary (TTS), in which case the animal's hearing threshold would recover over time (Southall et al., 2008). PTS is an auditory injury, which may vary in degree from minor to significant. Animals experiencing PTS or TTS will also likely experience some level of behavioral disturbance. Behavioral disturbance may include a variety of effects, including subtle changes in behavior (e.g., minor or brief avoidance of an area or changes in vocalizations), more conspicuous changes in similar behavioral activities, and more sustained and/or potentially severe reactions, such as displacement from or abandonment of high-quality habitat. Not all behavioral disturbance would have meaningful consequences to an individual. The duration of the disturbance and the activity that is impacted are considered when evaluating the potential for a behavioral disturbance to significantly disrupt normal behavioral patterns. An animal's perception of a threat may be sufficient to trigger stress responses consisting of some combination of behavioral responses, autonomic nervous system responses, neuroendocrine responses, or immune responses (e.g., Seyle, 1950; Moberg, 2000). In many cases, an animal's first and sometimes most economical response in terms of energetic costs is behavioral avoidance of the potential stressor. Autonomic nervous system responses to stress typically involve changes in heart rate, blood pressure, and gastrointestinal activity. These responses have a relatively short duration and may or may not have a significant long-term effect on an animal's fitness.

Criteria Used for Assessing Effects of Noise Exposure to Blue, Fin, Right, Sei, and Sperm Whales

NMFS *Technical Guidance for Assessing the Effects of Anthropogenic Noise on Marine Mammal Hearing* compiles, interprets, and synthesizes scientific literature to produce updated acoustic thresholds to assess how anthropogenic, or human-caused, sound affects the hearing of all marine mammals under NMFS jurisdiction (NMFS 2018[35], NMFS 2024). It identifies the received levels and auditory weighting functions, or "acoustic criteria," that describe the received levels (decibels (dB)) and frequencies (kilohertz (kHz)) where individual marine mammals are predicted to experience changes in their hearing sensitivity (auditory injury or temporary threshold shift (TTS)) from exposure to anthropogenic sound sources both in-air and underwater. Specifically, it identifies the received levels, or thresholds, at which individual marine mammals are predicted to experience temporary or permanent changes in their hearing sensitivity for acute, incidental exposure to underwater anthropogenic sound sources. The 2024 Update to: *Technical Guidance for Assessing the Effects of Anthropogenic Noise on Marine Mammal Hearing (Version 3.0)* [36] replaces NMFS's *2018 Revisions to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts* (2018 Revised Technical Guidance). The 2024 Updated Technical Guidance provides updated information, or acoustic criteria, to predict when individual marine mammals, both in-air and underwater, will experience changes in their hearing sensitivity (auditory injury or temporary threshold shift) from exposure to anthropogenic sound sources. The 2024 Updated Technical Guidance was finalized on October 24, 2024 (89 FR 84872). As explained in the document, these thresholds represent the best available scientific information. These acoustic thresholds cover the onset of both temporary (TTS) and permanent hearing threshold shifts (PTS). We consider the NMFS technical guidance the best scientific information available for assessing the effects of anthropogenic noise on marine mammals.

Table 7.1.6. Impulsive acoustic thresholds identifying the onset of auditory injury and

[35] See www.nmfs.noaa.gov/pr/acoustics/guidelines.htm for more information.
[36] https://www.fisheries.noaa.gov/s3/2024-10/Tech-Memo-Guidance-3.0-OCT2024-508-OPR1.pdf

temporary threshold shift for the marine mammal species groups considered in this opinion (NMFS 2024).

Hearing Group	Generalized Hearing Range[37]	Auditory Injury Onset[38] (received level)	Temporary Threshold Shift Onset
Low-Frequency Cetaceans (LF: baleen whales – blue, fin, right, sei)	7 Hz to 36 kHz	*L*p, 0-pk,flat: 222 dB* *L*E,p LF,24h: 183 dB	*L*pk,flat: 216 dB* *L*E,LF,24h: 168 dB
High-Frequency Cetaceans (HF: sperm whales) [note: formerly referred to as mid-frequency cetaceans in NMFS 2018]	150 Hz to 160 kHz	*L*p, 0-pk,flat: 230 dB *L*E,p, HF,24h: 193 dB*	*L*pk,flat: 224 dB *L*E,HF,24h: 178 dB*

Note: Peak sound pressure level (Lp,0-pk) has a reference value of 1 µPa, and weighted cumulative sound exposure level (LE,p) has a reference value of 1µPa2 s. In this Table, thresholds are abbreviated to be more reflective of International Organization for Standardization standards (ISO 2017). The subscript "flat" is being included to indicate peak sound pressure are flat weighted or unweighted within the generalized hearing range of marine mammals (i.e., 7 Hz to 160 kHz). The subscript associated with cumulative sound exposure level thresholds indicates the designated marine mammal auditory weighting function (LF, and HF cetaceans) and that the recommended accumulation period is 24 hours. The weighted cumulative sound exposure level thresholds could be exceeded in a multitude of ways (i.e., varying exposure levels and durations, duty cycle).
*notes change from NMFS 2018 to NMFS 2024.

These thresholds are a dual metric for impulsive sounds, with one threshold based on peak sound pressure level (0-pk SPL) that does not incorporate the duration of exposure, and another based on cumulative sound exposure level (SEL_{cum}) that does incorporate exposure duration. Cumulative SEL represents the total energy accumulated by a receiver over a defined time window or during an event. Peak sound pressure (also referred to as zero-to-peak sound pressure or 0-pk) is the maximum instantaneous sound pressure measurable in the water at a specified distance from the source. The cumulative sound exposure criteria incorporate auditory weighting functions, which estimate a species group's hearing sensitivity, and thus susceptibility to TTS and PTS, over the exposed frequency range, whereas peak sound exposure level criteria do not incorporate any frequency dependent auditory weighting functions.

In using these thresholds to estimate the number of individuals that may experience auditory effects in the context of the MMPA, NMFS classifies any exposure equal to or above the

[37] Represents the generalized hearing range for the entire group as a composite (i.e., all species within the group), where individual species' hearing ranges are typically not as broad. Generalized hearing range chosen based on approximately 65 dB threshold from normalized composite audiogram, with the exception for lower limits for LF cetaceans (Southall et al. 2008).

[38] *L*pk,flat: unweighted ($_{flat}$) peak sound pressure level (L_{pk}) with a reference value of 1 µPa; $LE,_{XF,24h}$: weighted (by species group; $_{LF}$: Low Frequency, or $_{HF}$: High-Frequency) cumulative sound exposure level (L_E) with a reference value of 1 µPa^2-s and a recommended accumulation period of 24 hours ($_{24h}$)

threshold for the onset of PTS as auditory injury (and, as explained by NMFS OPR, thus MMPA Level A harassment). As defined under the MMPA, Level A harassment means any act of pursuit, torment, or annoyance that has the potential to injure a marine mammal or marine mammal stock in the wild. NMFS considers exposure to impulsive noise greater than 160 dB re 1uPa rms to result in MMPA Level B harassment. As defined under the MMPA, Level B harassment refers to acts that have the potential to disturb (but not injure) a marine mammal or marine mammal stock in the wild by disrupting behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering. As defined in the MMPA, Level B harassment does not include an act that has the potential to injure a marine mammal or marine mammal stock in the wild. Among Level B exposures, NMFS OPR does not distinguish between those individuals that are expected to experience TTS and those that would only exhibit a behavioral response. The 160 dB re 1uPa rms threshold is based on observations of behavioral responses of mysticetes (Malme et al. 1983; Malme et al. 1984; Richardson et al. 1986; Richardson et al. 1990), but is used for all marine mammal species. As addressed further below, in this Opinion we consider the onset of auditory injury (PTS) and onset of behavioral disturbance thresholds in the context of the ESA definitions of take.

Consideration of 2024 Updated Technical Guidance for the SouthCoast MMPA action and this Opinion

In May 2024, NMFS announced the availability of a draft update to the *Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 3.0): Underwater and In-Air Criteria for Onset of Auditory Injury and Temporary Threshold Shifts* (draft Updated Technical Guidance) for public comment (89 FR 36762). For ESA listed whales that occur in the SouthCoast action area, the only relevant change to the marine mammal hearing group classification is the shift from classifying sperm whales as mid-frequency cetaceans to high-frequency cetaceans. The update includes revisions to both the marine mammal weighting functions and thresholds used to inform potential auditory injury and temporary threshold shift (TTS). As noted above, the 2024 Updated Technical Guidance was finalized on October 24, 2024 (89 FR 84872).

During the consultation period, NMFS OPR requested that SouthCoast provide an analysis of how the (proposed) updated technical guidance could affect exposure/take estimates as well as mitigation zone sizes for SouthCoast's proposed activities so that NMFS OPR could consider this information in the development of the Final ITR and associated LOA. SouthCoast submitted a report (LGL 2024) to NMFS OPR and BOEM on October 4, 2024; this report was modified based on NMFS OPR comments and resubmitted on October 19, 2024. As described in a November 1, 2024, memorandum, OPR reviewed SouthCoast's *Updated Marine Mammal Take Estimates and Shutdown Zones Modeling Report*, dated October 19, 2024, and found it accurately addresses the Updated Technical Guidance; therefore, they requested that we incorporate this new information into the Biological Opinion.

On November 1, 2024, NMFS OPR provided a memo summarizing the updates to exposure estimates and mitigation measures and identifying changes in NMFS OPR's proposed MMPA action. As described by SouthCoast (LGL 2024), to assess the extent that the changes to NMFS' updated technical guidance would have on exposure/take estimates, JASCO updated their acoustic assessments for these activities (to the extent practicable given the time remaining in the

ITR process), applying the new criteria to produced revised acoustic ranges, exposure ranges, and exposure estimates for impact pile driving and revised acoustic ranges for UXO detonation. The activities affected by these updates are impact pile driving for foundation installation (Level A harassment estimates) and potential unexploded ordnance (UXO) detonation (both Level A and Level B harassment estimates). The revised modeling result in an increase in SouthCoast's request for authorization as follows: Level A harassment of sei whales, pile driving: increase from 6 to 7 individuals; Level B harassment of fin (increase from 22 to 49), right whales (increase from 17 to 28), and sei whales (increase from 10 to 16) from exposure to UXO detonations; and, Level B harassment of right whales from HRG surveys, increase from 23 to 31. As noted in their November 1 memo, NMFS OPR is proposing to authorize these numbers of take by Level A and Level B harassment. Increased clearance/shutdown zones for baleen whales for pile driving and UXO detonations are proposed and reflected in the sections below.

Explosives Source Thresholds
Consistent with the updated 2024 Technical Guidance and the information in the MMPA Proposed Rule, based on the best scientific information available, NMFS uses the acoustic and pressure thresholds indicated in Table 7.1.7 below to predict the onset of PTS and TTS during UXO/MEC detonation. For a single detonation (within a 24-hour period), NMFS relies on the TTS onset threshold to assess the potential for Level B harassment.

Table 7.1.7 PTS onset, TTS onset, for underwater explosives (NMFS, 2024)

Hearing Group	PTS Impulsive Thresholds	TTS Impulsive Thresholds
Low-Frequency (LF) Cetaceans (baleen whales)	$L_{p\ 0\text{-}pk,flat}$: 222 dB $L_{E,LF,24h}$: 183 dB	$L_{pk,flat}$: 216 dB $L_{E,LF,24h}$: 168 dB
High-Frequency (HF) Cetaceans (sperm whales)	$L_{pk,flat}$: 230 dB $L_{E,HF,24h}$: 193 dB	$L_{pk,flat}$: 224 dB $L_{E,HF,24h}$: 178 dB
* Dual metric acoustic thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS/TTS onset. Note: Peak sound pressure (L_{pk}) has a reference value of 1 µPa, and cumulative sound exposure level (L_E) has a reference value of 1µPa^{2}s. In this table, thresholds are abbreviated to reflect American National Standards Institute standards (ANSI, 2013). However, ANSI defines peak sound pressure as incorporating frequency weighting, which is not the intent for this Technical Guidance. Hence, the subscript "flat" is being included to indicate peak sound pressure should be flat weighted or unweighted within the overall marine mammal generalized hearing range. The subscript associated with cumulative sound exposure level thresholds indicates the designated marine mammal auditory weighting function (LF, HF cetaceans) and that the recommended accumulation period is 24 hours. The cumulative sound exposure level thresholds could be exceeded in a multitude of ways (*i.e.*, varying exposure levels and durations, duty cycle). When possible, it is valuable for action proponents to indicate the conditions under which these acoustic thresholds will be exceeded.		

source: Table 8 in 89 FR 53708, NMFS 2024

Additional thresholds for non-auditory injury to lung and gastrointestinal (GI) tracts from the blast shock wave and/or onset of high peak pressures are also relevant (at relatively close ranges) as UXO/MEC detonations, in general, have potential to result in mortality and non-auditory injury (Table 7.1.8). Marine mammal lung injury criteria have been developed by the U.S. Navy (DoN (U.S. Department of the Navy), 2017) and are based on the mass of the animal and the depth at which it is present in the water column due to blast pressure. This means that specific decibel levels for each hearing group are not provided and instead, the criteria are presented as equations that allow for incorporation of specific mass and depth values. The GI tract injury threshold is based on peak pressure. The modified Goertner equations below represent the potential onset of lung injury and GI tract injury.

Table 7.1.8 Lung and G.I. tract injury thresholds (DoN, 2017)

Hearing Group	Mortality (Severe lung injury)*	Slight Lung Injury*	G.I. Tract Injury
All Marine Mammals	*Cell 1* Modified Goertner model; Equation 1	*Cell 2* Modified Goertner model; Equation 2	*Cell 3* $L_{pk,flat}$: 237 dB

* Lung injury (severe and slight) thresholds are dependent on animal mass (Recommendation: Table C.9 from DoN (2017) based on adult and/or calf/pup mass by species).

Note: Peak sound pressure (L_{pk}) has a reference value of 1 µPa. In this table, thresholds are abbreviated to reflect American National Standards Institute standards (ANSI, 2013). However, ANSI defines peak sound pressure as incorporating frequency weighting, which is not the intent for this Technical Guidance. Hence, the subscript "flat" is being included to indicate peak sound pressure should be flat weighted or unweighted within the overall marine mammal generalized hearing range.

Modified Goertner Equations for severe and slight lung injury (pascal-second)

Equation 1: $103M^{1/3}(1 + D/10.1)^{1/6}$ Pa-s

Equation 2: $47.5M^{1/3}(1 + D/10.1)^{1/6}$ Pa-s

M animal (adult and/or calf/pup) mass (kg) (Table C.9 in DoN, 2017)
D animal depth (meters)

source: Table 9 in 89 FR 53708

Definition of Harassment

As explained in NMFS Procedural Directive 02-110-22, (Effective Date October 21, 2016) given the differences in the definitions of "harassment" under the MMPA and ESA, "in practice, this may result in different outcomes under the MMPA and ESA analyses of an action, depending on the record in the particular matter." It is possible that some activities could result in harassment, as defined under the MMPA, but not meet the definition of harassment used by NMFS to determine whether ESA harassment is likely to occur. Likewise, it is possible that an act of disturbance determined to be harassment under the ESA might not be considered harassment under the MMPA. Under the ESA, take is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct." Harm is defined by regulation (50 C.F.R. §222.102) as "an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including, breeding, spawning, rearing, migrating, feeding, or sheltering." NMFS does not have a regulatory definition of "harass." However, on December 21, 2016, NMFS issued interim guidance[39] on the term "harass," under the ESA, defining it as to "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering." The NMFS Policy Directive explains that the ESA definition of "harass" does not specifically equate to MMPA Level A or Level B harassment. Due to the differences in the definition of "harass" under the MMPA and ESA, there may be activities that result in effects to a marine mammal that would meet the definition of harassment under both the MMPA and the ESA, while other activities may result in effects that would meet the definition of harassment under the MMPA but not under the ESA. Similarly, there may be instances where the effects of an activity are determined to cause harassment under the ESA but those effects do not meet the definition of Level A or Level B harassment under the MMPA. This issue is addressed further in the sections that follow.

For this consultation, we considered NMFS' interim guidance on the term "harass" under the ESA when evaluating whether the proposed activities are likely to harass ESA-listed species, and we considered the available scientific evidence to determine the likely nature of the behavioral responses and their potential fitness consequences.

7.1.3.1 Effects of Project Noise on ESA-Listed Whales

Here, we consider the effects of exposure and response to underwater noise during construction, operations, and decommissioning in the context of the ESA. Blue, fin, sei, sperm, and right whales occur in and adjacent to the SouthCoast WDA; individuals may be exposed to increased underwater noise from a variety of sources during construction, operation, and/or decommissioning of the SouthCoast project. Information on the relevant acoustic thresholds and a summary of the best available information on likely responses of whales to underwater noise was presented above.

In their MMPA ITA application[40], SouthCoast estimated exposure of marine mammals (including ESA listed blue, fin, right, sei, and sperm whales) known to occur in and around the lease area and along the cable corridor to a number of noise sources above the Level A and Level B harassment thresholds. As part of the response to the MMPA ITA application, OPR conducted their own review of the model reports and determined they were based on the best available information. OPR relied on the model results to develop the proposed rule (and draft LOA) which was published in June 2024. As noted above, updated analysis was reviewed by NMFS OPR in October 2024. As explained above in Section 3.0 *Description of the Proposed Action*, NMFS OPR proposes to authorize take by Level A harassment of 7 fin whales as a result of exposure to noise from impact pile driving and Level B harassment of a specified number of blue, fin, sei, sperm, and right whales as a result of exposure to noise from pile driving (vibratory and impact), UXO detonation, and HRG surveys. SouthCoast did not apply for an ITA to authorize take for any other noise sources, and OPR is not proposing to authorize MMPA take of

[39] NMFS Policy Directive 02-110-19; available at *https://media.fisheries.noaa.gov/dam-migration/02-110-19.pdf*; last accessed 10/7/24.

[40] https://www.fisheries.noaa.gov/action/incidental-take-authorization-southcoast-wind-llc-construction-southcoast-wind-offshore-wind; last accessed 10/7/24

any ESA listed whale species for any noise sources other than pile driving, UXO detonation, and HRG surveys. No serious injury or mortality is expected to result from exposure to any project noise sources and none is proposed to be authorized through the MMPA ITA.

As described below, NMFS GARFO has carried out our own independent analysis of the effects of exposure to these noise sources in the context of the ESA definition of take. For the purposes of this ESA Section 7 consultation, we evaluated the applicants' and OPR's exposure estimates of the number of ESA-listed marine mammals that would be "taken" relative to the definition of MMPA Level A and Level B harassment and considered this expected and authorized MMPA take in light of the ESA definition of take including the NMFS definition of harm (64 FR 60727; November 8, 1999) and NMFS interim guidance on the definition of harass (see NMFS policy directive 02-110-19[41]). We have independently evaluated and adopted OPR's analysis of the number of blue, fin, right, sei, and sperm whales expected to be exposed to foundation installation noise and UXO detonations because, after our independent review we determined it utilized the best available information and methods to evaluate exposure of these whale species to such noise.

WTG and OSP Foundation Installation - Acoustic Modeling of Pile Driving
The Proposed Rule (89 FR 53708) and BOEM's BA provide extensive information on the acoustic modeling prepared for the project (Limpert et al. 2024); this is supplemented by the additional information in LGL 2024. That information is summarized and applied here. As addressed above, BOEM and NMFS OPR will require use of a noise abatement system to achieve 10 dB noise attenuation for all pile driving; thus, modeling and exposure estimates incorporated 10 dB noise attenuation. Effectively achieving 10 dB noise attenuation is thus a critical element of modeling and this Opinion's effects analysis predicting exposure and the resultant number and type of take for each ESA listed whale species.

As described in the Proposed Rule, two locations within the WFA were selected for acoustic modeling of sounds fields from 16 m monopiles and 4.5 m pin piles; the modeling locations were selected as they represent the range of water depths in the lease area (see Figure 2 and 3 and Table 5 in Limpert et al. 2024). Average summer and winter sound speed profiles representative of the area were incorporated into the acoustic propagation modeling. As described in section 2.1 of Limpert et al. (2024), during the summer months (June-August), the average temperature of the upper 10 to 15 m of the water column is higher, resulting in an increased surface layer sound speed. This creates a downward refracting environment in which propagating sound interacts with the seafloor more than in a well-mixed environment. Increased wind mixing combined with a decrease in solar energy in the fall and winter months (September-February) results in a sound speed profile that is more uniform with depth. The shoulder months between summer and winter vary between the two.

As noted above, the acoustic thresholds for impulsive sounds (such as impact pile driving) contained in the NMFS Updated Technical Guidance (NMFS 2024) are dual metric acoustic thresholds using both SEL_{cum} and peak sound pressure level metrics (Table 7.1.6). As dual metrics, NMFS considers onset of acoustic injury (PTS) to have occurred when either one of the

41 Available at: https://www.fisheries.noaa.gov/national/laws-and-policies/protected-resources-policy-directives.

two metrics is exceeded. The SEL_{cum} metric considers both level and duration of exposure, as well as auditory weighting functions by marine mammal hearing group. As addressed further below, modeling may consider acoustic range or exposure range. For example, considering acoustic range, the distance from the source to the cumulative auditory injury onset threshold (e.g., received level of 183 dB for low frequency cetaceans and impulsive sound) marks the outer bound of the area within which an animal needs to stay for the entire duration of the activity considered (e.g., the entire four hours of pile driving to install a monopile); this contrasts to exposure range which models the "closest point of approach," which is the closest point of approach to the source made by a modeled animal (animat) that received enough acoustic energy to exceed a given threshold while it moved throughout the modeled sound field, accumulating received acoustic energy.

As described in the Proposed Rule, SouthCoast modeled both acoustic ranges and exposure ranges. Acoustic ranges represent the distance to a harassment threshold based on sound propagation through the environment (*i.e.*, independent of any receiver) while exposure range represents the distance at which an animal can accumulate enough energy to exceed a harassment threshold in consideration of how it moves through the environment (*i.e.*, using movement modeling). In both cases, the sound level estimates are calculated from three-dimensional sound fields and then, at each horizontal sampling range, the maximum received level that occurs within the water column is used as the received level at that range. These maximum-over-depth (R_{max}) values are then compared to predetermined threshold levels to determine exposure and acoustic ranges to onset of auditory injury and behavioral disturbance or TTS isopleths. However, the ranges to a threshold typically differ among radii from a source, and might not be continuous along a radii because sound levels may drop below threshold at some ranges and then exceed threshold at farther ranges. To minimize the influence of these inconsistencies, 5 percent of the farthest such footprints were excluded from the model data. The resulting range, $R_{95\%}$, was chosen to identify the area over which marine mammals may be exposed above a given threshold, because, regardless of the shape of the maximum-over-depth footprint, the predicted range encompasses at least 95 percent of the horizontal area that would be exposed to sound at or above the specified threshold.

For purposes of calculating estimated take by Level A harassment and Level B harassment, SouthCoast applied $R_{95\%}$ exposure ranges, not acoustic ranges for the reasons described below. Applying animal movement and behavior within the modeled noise fields provides the exposure range, which allows for a more realistic indication of the distances at which acoustic thresholds are reached that considers the accumulation of sound over different durations (note that in all cases the distance to the peak threshold is less than the SEL-based threshold). For modeled animals that have received enough acoustic energy to exceed a given threshold, the exposure range for each animal is defined as the closest point of approach (CPA) to the source made by that animal while it moved throughout the modeled sound field, accumulating received acoustic energy. The resulting exposure range for each species is the 95th percentile of the CPA distances for all animals that exceeded threshold levels for that species (termed the 95 percent exposure range $ER_{95\%}$). Notably, the $ER_{95\%}$ are species-specific rather than categorized only by hearing group, which affords more biologically-relevant data (*e.g.*, dive durations, swim speeds, etc.) to be considered when assessing impact ranges. More detail on the modeling approach is provided in the Proposed Rule and the modeling reports (Limpert et al. 2024, LGL 2024).

To estimate the probability of exposure of animals to sound above identified acoustic criteria during foundation installation, JASCO's Animal Simulation Model Including Noise Exposure (JASMINE) animal movement model was used to integrate the sound fields generated from the source and propagation models (considering 10 dB of sound attenuation) with species-typical behavioral parameters (*e.g.*, dive patterns). Sound exposure models like JASMINE use simulated animals ("animats") to sample the predicted 3-D sound fields with movement rules derived from animal observations. Animats that exceed NMFS' acoustic thresholds are identified and the range for the exceedances determined. The output of the simulation is the exposure history for each animat within the simulation. An individual animat's sound exposure levels are summed over a specific duration (24 hours, considering the maximum amount of pile driving proposed for a 24-hour period for each pile type modeled), to determine its total received acoustic energy (SEL), and maximum received PK and SPL. These received levels are then compared to the threshold criteria within each analysis period. The combined history of all animats gives a probability density function of exposure during the project. The number of animals expected to exceed the regulatory thresholds is determined by scaling the number of predicted animat exposures by the species-specific density of animals in the area. By programming animats to behave like marine species that may be present near the Lease Area, the sound fields are sampled in a manner similar to that expected for real animals. The parameters used for forecasting realistic behaviors (e.g., diving, foraging, and surface times) were determined and interpreted from marine species studies (e.g., tagging studies) where available, or reasonably extrapolated from related species. A full description of the model is provided in the Proposed Rule and in SouthCoast's MMPA Application. Note that animal aversion was not incorporated into the JASMINE model runs that were the basis for the take estimate for any species; that is, the models do not incorporate any animal movements or avoidance behavior that would be expected to result from exposure to underwater noise. The modeling also does not incorporate the clearance or shutdown requirements.

SouthCoast also calculated acoustic ranges which represent the distance to a harassment threshold based on sound propagation through the environment (*i.e.*, independent of any receiver). As described in the MMPA Proposed Rule, NMFS OPR typically considers acoustic ranges ($R_{95\%}$) to the onset of auditory injury SELcum metric thresholds to be very conservative as the accumulation of acoustic energy does not account for animal movement and behavior and therefore assumes that animals are essentially stationary at that distance for the entire duration of the pile installation, a scenario that does not reflect realistic animal behavior. Table 15 in the Proposed Rule includes the acoustic ranges (R95%) to the onset of acoustic injury (PTS) SPLpeak threshold for the different pile types during impact pile driving; this table was updated in the November 1 memo sent from NMFS OPR; however the range of distances remain the same, with distances to the peak threshold ranging from 120-270 m from the pile being installed. Table 17 in the Proposed Rule contains the acoustic ranges (R95%) to the Level B harassment thresholds for impact and vibratory installation of the different pile types in summer and winter; these distances were used to define the Level B harassment zone for WTG and OSP foundation installation in the Proposed Rule and the minimum visibility zone for installation of foundations in the NARW EMA (as addressed further below).

Modeling was carried out to estimate sound fields for monopile and jacket foundations installed sequentially (i.e., one pile at a time) and concurrently (i.e., installation of a WTG and OSP foundation at the same time, which would occur for up to four days per project). For monopile and WTG jacket foundations, modeling was carried out for impact-only installation and for installation with vibratory pile setting followed by impact pile driving (noting that vibratory pile setting is only proposed for Project 2). Tables 19-23 in the Proposed Rule summarize the monthly construction schedules for each scenario incorporated into the modeling, including installation sequence and method, and the number of pile driving days per month. As noted there, construction schedules cannot be fully predicted due to uncontrollable environmental factors (*e.g.*, weather) and installation schedules include variability (*e.g.*, due to drivability). The total number of construction days per month would be dependent on a number of factors, including environmental conditions, planning, construction, and installation logistics. Consistent with the description of the proposed action, the modeling incorporated the following schedule constraints: for sequential WTG foundation installations a maximum of 2 WTG monopiles or 4 OSP piled jacket pin piles may be driven in 24 hours; for concurrent installation, a maximum of 1 WTG monopile and 4 OSP pin piles or 4 WTG pin piles and 4 OSP pin piles may be driven in 24 hours. OPR determined that while it is unlikely that these maximum installation rates would be consistently attainable throughout the construction phase, this schedule was considered to have the greatest potential for Level A harassment (PTS) and given that it was possible, it was carried forward into determining estimates of MMPA take.

Tables 7.1.9-7.11 include the species specific exposure ranges ($ER_{95\%}$) to the auditory injury (PTS) threshold for the identified installation scenarios for monopile and jacket foundations, including the ranges using the summer and winter sound speed profiles. Exposure modeling for blue whales was not conducted because blue whale density was considered too low to be carried into exposure estimation.

Table 7.1.9 – Exposure Ranges ($ER_{95\%}$)[1] to the Marine Mammal Onset of Acoustic Injury (PTS) Cumulative Sound Exposure Level (SEL_{cum}) Thresholds for Sequential Impact Pile Driving Installation of One or Two 9/16-m WTG Monopiles, Four 4.5-m WTG Jacket Pin Piles, or Four 4.5-m OSP Jacket Pin Piles in One Day, Incorporating 10 dB of Broadband Noise Attenuation in Summer (S) and Winter (W)[2]

Species	SEL_{cum} Threshold (dB re 1 µPa2 ·s)	Range (km)							
		9/16-m WTG Monopiles (1 piles/day)		9/16-m WTG Monopiles (2 piles/day)		4.5-m WTG Jacket Pin Piles (4 piles/day)		4.5-m OSP Jacket Pin Piles (4 piles/day)	
		S	W	S	W[3]	S	W	S	W
Blue whale	183	-	-	-	-	-	-	-	-
Fin whale		4.57	4.97	4.61	-	2.69	3.12	3.52	3.50

N.Atl. right whale		3.31	3.61	3.28	-	1.89	2.01	2.27	2.13
Sei whale		3.43	3.88	3.58	-	2.30	2.61	2.77	2.72
sperm whale	193	0	0	0	-	0	0	0	0

1 – These are the maximum $ER_{95\%}$ values among modeling locations (L01 and L02 in Limpert et al., 2024).
2 – For acoustic propagation modeling, two average sound speed profiles were used, one for the "summer" season (May-November) and a second for the "winter" season (December)
3 – Given the small number of foundation installations planned for December (see tables 19-23), modeling assumed installation of only a single monopile per day for "winter."

source: Table 24 in 89 FR 53708, updates from LGL 2024 (LGL 2024 did not contain a table with post-piled jackets, winter)

Table 7.1.10– Exposure Ranges ($ER_{95\%}$)[1] to the Marine Mammal Onset of Acoustic Injury (PTS) Cumulative Sound Exposure Level (SEL_{cum}) Thresholds During Sequential Vibratory[2] and Impact Pile Driving Installation of One or Two 9/16-m WTG Monopiles or Four 4.5-m WTG Jacket Pin Piles Incorporating 10 dB of Attenuation in Summer[3]

Species	SEL_{cum} Threshold (dB re 1 $\mu Pa^2 \cdot s$)	Range (km)					
		WTG Monopile (1 pile/day)		WTG Monopile (2 piles/day)		WTG Jacket Pin Piles (4 piles/day)	
		Impact	Vibratory	Impact	Vibratory	Impact	Vibratory
Blue whale	183	-	-	-	-	-	-
Fin whale		4.93	0	5.02	0	2.82	0
N.Atl. right whale		3.44	0	3.38	0	1.91	0
Sei whale		3.67	0	3.68	0	2.23	0
sperm whale	193	0	0	0	0	0	0

1 – These are the maximum $ER_{95\%}$ values among modeling locations (L01 and L02 in Limpert et al., 2024).
2 – SouthCoast proposed vibratory pile driving for Project 2 (Scenarios 2 and 3) but not for Project 1.
3 – For acoustic propagation modeling, two average sound speed profiles were used, one for the "summer" season (May-November) and a second for the "winter" season (December). Modeling assumed vibratory pile driving would only occur in "summer," thus, table 25 does not present "winter" values.

source: Table 25 in 89 FR 53708, updates from LGL 2024

Table 7.1.11 – Exposure Ranges ($ER_{95\%}$)[1] to the Marine Mammal Onset of Acoustic Injury (PTS) Cumulative Sound Exposure Level (SEL_{cum}) Thresholds During Concurrent[2] Impact Pile Driving Installation of Two 9/16-m WTG Monopiles And Four 4.5-m OSP Jacket Pin Piles, or Four 4.5-m WTG Jacket Pin Piles[2] and Four 4.5-m OSP Jacket Pin Pile in One Day Assuming 10 dB of Broadband Noise Attenuation in Summer[3]

Species	SEL_{cum} Threshold (dB re 1 µPa^2 ·s)	Range (km)	
		16-m WTG Monopiles (1 piles/day) and 4.5-m OSP Jacket Pin Piles (4 piles/day)	4.5-m WTG Jacket Pin Piles (4 piles/day) and 4.5-m OSP Jacket Pin Piles (4 piles/day)
Blue whale	183	-	-
Fin whale		4.64	4.09
N.Atl. right whale		3.24	2.52
Sei whale		3.72	2.89
sperm whale	193	0	0

1 – These are the maximum $ER_{95\%}$ values among modeling locations (L01 and L02 in Limpert *et al*., 2024).
2 – SouthCoast proposed concurrent impact pile driving of WTG and OSP foundations for Projects 1 and 2.
3 – For acoustic propagation modeling, two average sound speed profiles were used, one for the "summer" season (May-November) and a second for the "winter" season (December).

source: Table 26 in 89 FR 53708 (as corrected by OPR during the consultation period to reflect that concurrent pile driving would be for 1 monopile/day not 2 monopiles/day and updated in LGL 2024)

Exposure modeling was also carried out to produce $ER_{95\%}$ distances to the 60 dB SPL_{rms} (impact pile driving) and 120 dB SPL_{rms} (vibratory pile driving) thresholds. The following tables provide the Level B harassment $ER_{95\%}$ distances for: 1) sequential installation of WTG foundations using only impact pile driving for summer and winter; 2) summer-only sequential installation of WTG foundations (both monopile and pin-piled jacket) using both vibratory and impact pile driving; and 3) concurrent installation of WTG monopile and OSP pin-piled jacket foundations (limited to "summer").

Table 7.1.12 – Exposure Ranges ($ER_{95\%}$)[1] to the Marine Mammal 160 dB Behavioral Disturbance (SPL_{rms}) Threshold for Sequential Impact Pile Driving Installation of One or Two 9/16-m WTG Monopiles, Four 4.5-m WTG Jacket Pin Piles, or Four 4.5-m OSP Jacket Pin Piles in One Day, Incorporating 10 dB of Broadband Noise Attenuation in Summer (S) And Winter (W)[2]

Species	Range (km)			

	9/16-m WTG Monopiles (1 piles/day)		9/16-m WTG Monopiles (2 piles/day)		4.5-m WTG Jacket Pin Piles (4 piles/day)		4.5-m OSP Jacket Pin Piles (4 piles/day)	
	S	W	S	W[3]	S	W	S	W
North Atlantic Right whale	6.82	7.66	6.71	–	3.73	3.85	4.28	4.54
Blue Whale	–	–	–	–	–	–	–	–
Fin Whale	7.08	8.33	7.03	–	3.92	4.27	4.55	4.94
Sei Whale	7.04	8.17	6.86	–	3.85	3.90	4.42	4.88
Sperm Whale	6.93	7.93	6.75	–	3.73	3.92	4.34	4.72

1 – These are the maximum $ER_{95\%}$ values among modeling locations (L01 and L02 in Limpert *et al.*, 2024).
2 – For acoustic propagation modeling, two average sound speed profiles were used, one for the “summer” season (May-November) and a second for the “winter” season (December).
3 – Given the small number of foundation installations planned for December (see tables 19-23), modeling assumed installation of only a single monopile per day for “winter.”
source: Table 27 in 89 FR 53708

Table 7.1.13 – Exposure Ranges ($ER_{95\%}$)[1] to the Marine Mammal 160 dB and 120 dB Behavioral Disturbance (SPL_{rms}) Thresholds During Sequential Vibratory[2] and Impact Pile Driving Installation of One or Two 9/16-m WTG Monopiles[3] or Four 4.5-m WTG Jacket Pin Piles[4] Incorporating 10 dB of Broadband Noise Attenuation in Summer[5]

Species	Range (km)					
	WTG Monopile (1 pile/day)		WTG Monopile (2 piles/day)		WTG Jacket Pin Piles (4 piles/day)	
	Impact	Vibratory	Impact	Vibratory	Impact	Vibratory
North Atlantic right whale	6.77	39.14	6.72	38.20	5.12	15.21
Blue Whale	-	-	-	-	-	-
Fin Whale	7.06	41.83	7.00	41.69	5.48	15.75
Sei Whale	7.01	41.15	6.87	40.46	5.35	15.43
Sperm Whale	6.83	40.64	6.81	40.27	5.32	15.27

1 – These are the maximum $ER_{95\%}$ values among modeling locations (L01 and L02 in Limpert et al., 2024).
2 – SouthCoast proposed vibratory pile driving for Project 2, Scenarios 2 and 3, but not for Project 1.
3 – Monopiles installed by 20 minutes of vibratory pile driving using HX-CV640 hammer followed by 5,000 strikes using NNN 6600 impact hammer

4 – Pin piles installed by 90 minutes of vibratory pile driving using S-CV640 hammer followed by 2,667 strikes using MHU 3500S impact hammer
5 – For acoustic propagation modeling, two average sound speed profiles were used, one for the "summer" season (May-November) and a second for the "winter" season (December). Modeling assumed vibratory pile driving would only occur in "summer," thus, table 28 does not present "winter" values.

source: Table 28 in 89 FR 53708

Table 7.1.14 – Exposure Ranges ($ER_{95\%}$) to the Marine Mammal 160 dB Behavioral Disturbance (SPL_{rms}) Threshold During Concurrent Impact Pile Driving Installation of Two 9/16-m WTG Monopiles and Four 4.5-m OSP Jacket Pin Piles, or Four 4.5-m WTG Jacket Pin Piles and Four 4.5-m OSP Jacket Pin Pile in One Day Incorporating 10 dB of Broadband Noise Attenuation in the Summer [1]

Species	Range (km)	
	16-m WTG Monopiles (1 pile/day) and 4.5-m OSP Jacket Pin Piles (4 piles/day)	4.5-m WTG Jacket Pin Piles (4 piles/day) and 4.5-m OSP Jacket Pin Piles (4 piles/day)
Fin whale	7.19	4.98
N.Atl. right whale	6.52	4.50
Sei whale	6.97	4.75
sperm whale	6.60	4.75

1 – For acoustic propagation modeling, two average sound speed profiles were used, one for the "summer" season (May-November) and a second for the "winter" season (December). Modeling assumed concurrent installations would only occur in October, thus table 29 present values for summer only.

source: Table 29 in 89 FR 53708 (as corrected by OPR during the consultation period to reflect distances to the behavioral disturbance thresholds and that concurrent pile driving would be for 1 monopile/day not 2 monopiles/day)

For their MMPA application, SouthCoast modeled potential Level A harassment and Level B harassment density-based exposure estimates for all five foundation installation schedules, all of which include sequential pile driving and concurrent pile driving (with concurrent pile driving limited to days when OSP and WTG foundation piles are both installed). For the installation schedules used for exposure modeling, the total number of installations was spread across all potential months in which they might occur (May-December) in order to incorporate the month-to-month variability in species densities. The foundation installation scenarios used in the modeling are summarized in Table 7.1.15. Note that, for the purposes of exposure modeling, SouthCoast incorporated installation of two OSPs (one per Project), each supported by a piled jacket foundation secured by 12 to 16 pin piles (requiring up to four days of OSP pin pile driving for each project). The modeling incorporated planned installation of the OSP foundations in October for each Project.

Table 7.1.15 – Foundation Installation Scenarios

Scenario	Method: Impact or Vibratory	WTG Foundation Type	WTG foundation Number	OSP Pin Pile Number	Piling Days
Project 1					
Scenario 1	Impact	Monopile	71	12	59
Scenario 2	Impact	Jacket	85	16	85
Project 2					
Scenario 1	Impact	Monopile	68	12	53
Scenario 2	Both	Monopile	73	12	49
Scenario 3	Both	Jacket	62	16	62

source: Table 31 in 89 FR 53708

For both WTG and OSP foundation installations, mean monthly densities were calculated by first selecting density data from 5 x 5 km (3.1 x 3.1 mi) grid cells (Roberts *et al.*, 2016; 2023) both within the Lease Area and beyond its boundaries to perimeter distances based on the ranges to the Level A and Level B harassment thresholds (see Tables above). For each species, foundation type and number, installation method, and season, the most appropriate density perimeter was selected from the predetermined distances (*i.e*., 1 km (0.6 mi), 5 km (3.1 mi), 10 km (6.2 mi), 15 km (9.3 mi), 20 km (12.4 mi), 30 km (18.6 mi), 40 km (25 mi), and 50 km (31.1 mi)) by rounding the $ER_{95\%}$ up to the nearest predetermined perimeter size. See tables in Section H.2.1.1 of Appendix H in Limpert *et al*. (2024) for densities within the defined areas**.**

As explained in the Proposed Rule, SouthCoast calculated take estimates for all five foundation installation scenarios, based on modeled exposures as well as in consideration of PSO data (from surveys carried out in and around the Lease Area) and in consideration of mean group sizes. With the exception of blue whales, for all ESA listed species, the take estimates generated from density-based exposure estimates were highest and were carried forward. For blue whales, given the low density in the area but recognizing the expected occurrence of the species in the area, SouthCoast and OPR anticipate exposure of no more than one group size annually. Tables 32-36 in the Proposed Rule provide the results of marine mammal exposure modeling, which incorporates 10-dB attenuation and seasonal restrictions, for each scenario; updated exposure estimates are provided in LGL 2024. The Level A harassment exposure estimates represent animats that exceeded the PTS SELcum thresholds as this metric was exceeded prior to exceeding PTS SPL_{peak} thresholds. The Level B harassment exposure estimates shown for Project 1 Scenarios 1 and 2, and Project 2 Scenario 1 represent animats exceeding the unweighted 160 dB SPL_{rms} criterion because impact pile driving would be the only installation method in these scenarios. The Level B harassment exposure estimates shown for Project 2 Scenarios 2 and 3 (tables 32-36) represent animats exceeding the unweighted 120 dB SPL_{rms} and/or 160 dB SPL_{rms} criteria because these scenarios include both vibratory and impact pile driving. Columns 4 and 5 in tables 32-36 show what the take estimates would be if the PSO data or average group size, respectively, were used to inform the number of proposed takes by Level B harassment in lieu of the density and exposure modeling. The last column represents the total Level B harassment take estimate for each species, based on the highest of the three estimates (density-based exposures, PSO data, or average group size). For Project 1, no single scenario results in a greater amount of take for all species; therefore, the maximum annual and 5-year total amount of take proposed for authorization by NMFS OPR is a combination of both scenarios depending on species (*i.e.*, the scenario which resulted in the greatest amount of take was carried forward for each species). For Project 2, Scenario 2 results in the greatest amount of take for all species and is carried forward in the maximum annual and 5-year total amount of take proposed for authorization.

The tables below include the exposure estimates and the MMPA take estimates for each scenario considered for Project 1 and Project 2.

Table 7.1.16 – Project 1 Scenario 1 (P1S1): Estimated MMPA Level A Harassment[1] and Level B Harassment[2] Take From Installation of 71 WTG Monopile Foundations and 12 OSP Jacket Pin Piles, Assuming 10 dB of Noise Attenuation

Species	Level A Harassment Exposure Modeling Take Estimate P1S1	Level B Harassment Exposure Modeling Take Estimate P1S1	PSO Data Take Estimate	Mean Group Size	Estimated Level A Harassment Take P1S1	Estimated Level B Harassment Take P1S1
Blue whale	N/A	N/A	-	1.0	0	1
Fin whale	16.1	38.8	3.4	1.8	17	39
North Atlantic right whale	2.5	8.8	-	2.4	3	9
Sei whale	1.54	4.7	0.9	1.6	2	5
Sperm whale	0.0	12.4	0.3	2.0	0	13

1 – Level A harassment take estimates assumes no implementation of monitoring and mitigation measures beyond 10-dB attenuation using a Noise Mitigation System, and seasonal restrictions.
2 – Level B harassment take estimates are based on distances to the unweighted 120 dB threshold for vibratory pile driving and 160 dB threshold for impact pile driving
source: Table 32 in 89 FR 53708, with modeled Level A estimates updated in LGL 2024

Table 7.1.17 – Project 1 Scenario 2 (P1S2): Estimated MMPA Level A Harassment[1] and Level B Harassment[2] Take From Installation of 85 Piled Jacket WTG Foundations and 16 OSP Jacket Pin Piles Assuming 10 dB of Noise Attenuation

Species	Level A Harassment Exposure Modeling Take Estimate P1S2	Level B Harassment Exposure Modeling Take Estimate P1S2	PSO Data Take Estimate	Mean Group Size	Estimated Level A Harassment Take P1S2	Estimated Level B Harassment Take P1S2
Blue whale	N/A	N/A	-	1.0	0	1
Fin whale	12.8	22.4	3.8	1.8	13	23
North Atlantic right whale	4.7	12.0	-	2.4	4	12
Sei whale	2.7	6.1	1.0	1.6	3	7
Sperm whale	0.0	10.0	0.3	2.0	0	10

1 – Level A harassment take estimates assumes no implementation of monitoring and mitigation measures beyond 10-dB attenuation using a Noise Mitigation System, and seasonal restrictions.
2 – Level B harassment take estimates are based on distances to the unweighted 120 dB threshold for vibratory pile driving and 160 dB threshold for impact pile driving
source: Table 33 in 89 FR 53708, with modeled Level A harassment exposure estimates updated in LGL 2024

Table 7.1.18 – Project 2 Scenario 1 (P2S1): Estimated Level A Harassment[1] and Level B Harassment[2] Take From Installation of 68 Monopile WTG Foundations and 12 OSP Jacket Pin Piles Assuming 10 dB of Noise Attenuation

Species	Level A Harassment Exposure Modeling Take Estimate P2S1	Level B Harassment Exposure Modeling Take Estimate P2S1	PSO Data Take Estimate	Mean Group Size	Estimated Level A Harassment Take P2S1	Estimated Level B Harassment Take P2S1
Blue whale	N/A	N/A	-	1.0	0	1
Fin whale	13.4	31.9	3.2	1.8	14	32
North Atlantic right whale	2.6	9.1	-	2.4	3	10
Sei whale	1.8	5.2	0.8	1.6	2	6

Sperm whale	0.0	10.4	0.3	2.0	0	11

1 – Level A harassment take estimates assumes no implementation of monitoring and mitigation measures beyond 10-dB attenuation using a Noise Mitigation System, and seasonal restrictions.
2 – Level B harassment take estimates are based on distances to the unweighted 120 dB threshold for vibratory pile driving and 160 dB threshold for impact pile driving
source: Table 34 in 89 FR 53708, with modeled Level A harassment exposure estimates updated in LGL 2024

Table 7.1.19 – Project 2 Scenario 2 (P2S2): Estimated Level A Harassment[1] and Level B Harassment[2] Take From Installation of 73 Monopile WTG Foundations and 12 OSP Jacket Pin Piles Assuming 10 dB of Noise Attenuation

Species	Level A Harassment Exposure Modeling Take Estimate P2S2	Level B Harassment Exposure Modeling Take Estimate P2S2	PSO Data Take Estimate	Mean Group Size	Estimated Level A Harassment Take P2S2	Estimated Level B Harassment Take P2S2
Blue whale	N/A	N/A	-	1.0	0	1
Fin whale	17.5	482.0	7.2	1.8	18	481
North Atlantic right whale	2.7	100.0	-	2.4	3	100
Sei whale	1.7	41.9	1.9	1.6	2	42
Sperm whale	0.0	121.4	0.6	2.0	0	122

1 – Level A harassment take estimates assumes no implementation of monitoring and mitigation measures beyond 10-dB attenuation using a Noise Mitigation System, and seasonal restrictions.
2 – Level B harassment take estimates are based on distances to the unweighted 120 dB threshold for vibratory pile driving and 160 dB threshold for impact pile driving.
source: Table 35 in 89 FR 53708, with modeled Level A harassment exposure estimates updated in LGL 2024

Table 7.1.20 – Project 2 Scenario 3 (P2S3): Estimated Level A Harassment[1] and Level B Harassment[2] Take From Installation of 62 Piled Jacket WTG Foundations and 16 OSP Jacket Pin Piles Assuming 10 dB of Noise Attenuation

Species	Level A Harassment Exposure Modeling Take Estimate P2S3	Level B Harassment Exposure Modeling Take Estimate P2S3	PSO Data Take Estimate	Mean Group Size	Estimated Level A Harassment Take P2S3	Estimated Level B Harassment Take P2S3

Blue whale	N/A	N/A	-	1.0	0	1
Fin whale	10.3	113.0	3.4	1.8	11	113
North Atlantic right whale	3.9	40.0	-	2.4	4	40
Sei whale	2	18.0	0.9	1.6	2	19
Sperm whale	0.0	35.1	0.3	2.0	0	36

1 – Level A harassment take estimates assumes no implementation of monitoring and mitigation measures beyond 10-dB attenuation using a Noise Mitigation System, and seasonal restrictions.
2 – Level B harassment take estimates are based on distances to the unweighted 120 dB threshold for vibratory pile driving and 160 dB threshold for impact pile driving.
source: Table 36 in 89 FR 53708, with modeled Level A harassment exposure estimates updated in LGL 2024

As described in the Proposed Rule, NMFS OPR considers that the model-based Level A harassment (PTS) exposure estimates are conservative in that they assume no mitigation measures other than 10 dB of sound attenuation and seasonal restrictions. Although the enhanced mitigation and monitoring measures incorporated into the proposed action are specifically focused on reducing pile-driving impacts on North Atlantic right whales, other marine mammal species would experience conservation benefits as well (e.g., extended seasonal restrictions, increased monitoring effort and larger minimum visibility zone improving detectability and mitigation efficacy, extended pile-driving delays (24-48 hours) if a North Atlantic right whale is detected). When implemented, the mitigation measures included in the description of the proposed action, including soft-start and clearance/shutdown processes, would reduce the already very low probability of auditory injury. Additionally, modeling does not incorporate any avoidance behavior by the animals, yet we know many marine mammals avoid areas of loud sounds. Thus, it is unlikely that an animal would remain within the area where noise is above the auditory injury threshold long enough to incur PTS and would be expected to redirect their movements away from the pile installation location in response to the soft-start procedure. For these reasons, SouthCoast did not request authorization for Level A harassment (PTS) take incidental to foundation installation for most marine mammal species, even though animal movement modeling estimated a small number of PTS exposures (Tables 7.1.16-7.1.20 above). In the case of North Atlantic right whales, OPR determined that the potential for Level A harassment (PTS) has been reduced to a *de minimis* likelihood due to the enhanced mitigation and monitoring measures, which include even larger clearance and shutdown zones. SouthCoast did not request, and NMFS OPR is not proposing to authorize, take by Level A harassment of North Atlantic right whales. NMFS OPR also concluded that take by Level A harassment of sei whales would be avoided through the mitigation measures and is not proposing to authorize any take by Level A harassment of sei whales.

As explained in the MMPA Proposed Rule, SouthCoast requested authorization for Level A harassment take for 20% of the modeled exposures of fin whales. In most installation scenarios, 15-20 percent of the fin whale Level A harassment $ER_{95\%}$ zone extends beyond the proposed clearance/shutdown distance for non-NARW baleen whales, therefore, SouthCoast requested authorization for Level A take for fin whales incidental to foundation installation equivalent to 20 percent of the fin whale Level A exposure estimates produced by the exposure modeling (Project 1 = 16; Project 2 = 18, considering the updated MMPA proposed action). This results in a request for authorization of a total of 7 Level A harassment takes for fin whales across both Project 1 and Project 2. As reflected in the November 1 memo, NMFS OPR is proposing to authorize this amount of Level A harassment of fin whales.

As explained in the MMPA Proposed Rule, for Project 1, no single scenario resulted in a greater amount of take for all species; therefore, the annual Level B harassment take numbers carried forward in table 37 of the Proposed Rule reflect the maximum take estimate for each species between the two possible foundation installation scenarios (P1S1 and P1S2). Similarly, for Project 2, the number of species-specific Level B harassment takes in table 37 reflects the maximum take estimate among the three analyzed scenarios (P2S1, P2S2, P2S3) which, in all cases, resulted from installations of P2S2. However, the 5-year total take incidental to foundation installation proposed for authorization for a given species (shown in the last two columns in table 37) is less than the direct sum across Projects 1 and 2 values in the columns to the left. This is because the total number of takes must be based on a realistic construction scenario sequence that does not include take estimates resulting from modeling of installation of more than 149 foundations. For example, the number of estimated sei whale Level B harassment takes in column 3 of table 37 resulted from modeling installation of Project 1 Scenario 2 (85 WTG foundations) and the number in column 5 resulted from modeling installation of Project 2 Scenario 2 (73 WTG foundations), representing take incidental to installation of a number of WTG foundations (158) larger than the maximum in SouthCoast's PDE (147). As described previously, some combinations of Project 1 and 2 scenarios are not possible because they would exceed the number of foundation positions available. However, SouthCoast indicates that the scenario chosen for Project 2 is dependent on the scenario installed for Project 1, which is uncertain at this time. Given this uncertainty, SouthCoast considers each of the five installation scenarios (Project 1, Scenarios 1 or 2; Project 2, Scenarios 1-3) described in table 2 possible. To ensure the total take proposed for authorization is based on a realistic number of foundations, the 5-year total is based on installation of Project 1 Scenario 1 and Project 2 Scenario 2 (146 total foundations). This ensures that the take proposed for authorization for Project 2 represents the maximum possible yearly take among the three scenarios considered for Project 2 as it is estimated using the largest potential ensonified zone (resulting from vibratory pile driving) and that sufficient take is requested for the full buildout. SouthCoast also considers the combination of Project 1 Scenario 2 and Project 2 Scenario 3 (147 total foundations) a realistic construction plan. However, the 5-year take request is based on Project 1 Scenario 1 combined with Project 2 Scenario 2 because it reflects a realistic construction plan that results in the greatest number of estimated takes. We agree that as the amount of Level A and Level B harassment proposed for authorization by NMFS OPR reflects a construction scenario that is within the description of the proposed action and is reasonably certain to occur: it represents a reasonable maximum amount of exposures that can be expected across Project 1 and 2 together.

Table 7.1.21 – Level A Harassment (PTS) and Level B Harassment Take Incidental to WTG and OSP Foundation Installation Proposed to be Authorized by NMFS OPR through issuance of an MMPA ITA

Species	Amount of MMPA Take Proposed for Authorization by NMFS OPR	
	Total (Based on Realistic Combination of Project 1 Scenario 1 and Project 2 Scenario 2)	
	Level A Harassment	Level B Harassment
Blue whale	0	2
Fin whale	7	520
North Atlantic right whale	0	109
Sei whale	0	47
Sperm whale	0	135

source: Table 37 in 89 FR 53708, NMFS OPR November 1 Memo

7.1.3.1 Consideration of Required Measures to Minimize Exposure of ESA Listed Whales to Pile Driving Noise

Here, we consider the measures that are part of the overall proposed action, either because they are proposed by SouthCoast in the COP, or are proposed to be required by BOEM as conditions of COP approval or by NMFS OPR through conditions of the proposed MMPA ITA, and how those measures may serve to minimize exposure of ESA listed whales to pile driving noise. Details of these proposed measures are included in Section 3.0 *Description of the Proposed Action* above.

Seasonal Restriction on Impact Pile Driving of Foundations

No pile driving activities would occur between January 1 and May 15 in any portion of the lease to avoid the time of year with the highest densities of right whales in the WDA. Additionally, in the NARW EMA, no pile driving would occur between October 16 and May 31. These seasonal restrictions are factored into the acoustic modeling that supported the development of the amount of take proposed in the ITA. That is, the modeling does not consider any pile driving in the moratorium periods. Thus, the take estimates do not need to be adjusted to account for this seasonal restriction.

Sound Attenuation Devices and Sound Field Verification

For all pile driving, SouthCoast is required to implement sound attenuation technology that would achieve at least a 10 dB reduction in pile driving noise; BOEM and NMFS OPR are requiring that the noise mitigation device(s) perform such that measured ranges to the Level A and Level B harassment thresholds are consistent with (i.e., no larger than) those modeled assuming 10 dB attenuation, determined via sound source verification; noting that we anticipate for distances determined via exposure ranges, the corresponding acoustic ranges will be used for SFV comparison). Together, the purpose of the requirements to utilize sound attenuation devices (also referred to as noise or sound mitigation measures) and sound field verification (i.e., in situ noise monitoring during pile installation) are to ensure that SouthCoast does not exceed the modeled distances to the Level A and Level B harassment thresholds for ESA listed marine mammals (modeled assuming 10 dB attenuation). The sound field verification related measures are based on the expectation that SouthCoast's initial pile driving methodology and sound attenuation measures will result in noise levels that do not exceed the identified distances (as modeled assuming 10 dB attenuation) but, if that is not the case, provide a step-wise approach for modifying or adding sound attenuation measures that can reasonably be expected to achieve those metrics prior to the next pile being installed.

The 10 dB attenuation was incorporated into the take estimate calculations presented above. Thus, the take estimates do not need to be adjusted to account for the use of sound attenuation. If a reduction greater than 10 dB is achieved, the actual amount or extent of take would be expected to be lower as a result of resulting smaller distances to thresholds of concern. Above, we provided an explanation for why it is reasonable to expect that 10 dB of sound attenuation for pile driving can be achieved assuming proper deployment and maintenance of sound attenuation devices, with the most recent information indicating that proper deployment and continuous maintenance of a dBBC (with or without a nearfield attenuation device) provides the highest likelihood of consistent success (i.e. SFV reports for the CVOW, Revolution Wind, South Fork and Vineyard Wind 1 projects). We note that based on the requirements, SouthCoast will use at least a dBBC.

As required by the proposed ITR and conditions of COP approval, SouthCoast will conduct thorough sound field verification for at least the first three WTG monopiles, first four WTG pin piles, and all OSP jacket foundation pin piles. SouthCoast is also required to conduct thorough sound field verification of any additional piles in locations that are not represented by the previous locations where sound field verification was carried out or where pile specifications or installation methodology suggests that noise will be louder than piles for which SFV was already carried out (e.g., larger piles, higher hammer energy, greater number of strikes). As required by the proposed ITR, thorough SFV measurements must continue until at least three consecutive monopiles and four consecutive pin piles demonstrate noise levels are at or below those modeled, assuming 10 dB of attenuation. Abbreviated SFV (consisting of measurements from a single hydrophone location) is required for all piles. Additional details of the required sound field verification are included in the Proposed Rule and draft LOA.

The required sound field verification will provide information necessary to confirm that the sound source characteristics predicted by the modeling are reflective of actual sound source characteristics in the field. As described in the Proposed Rule, if sound field verification measurements on any of the first three monopiles, first four WTG pin piles or any OSP jacket foundation pin piles indicate that the ranges to Level A harassment or Level B harassment isopleths are larger than those modeled, assuming 10-dB attenuation, SouthCoast must modify and/or apply additional noise attenuation measures (e.g., improve efficiency of bubble curtain(s), modify the piling schedule to reduce the source sound, install an additional noise attenuation device) for subsequent piles of the same type/installation methodology. Until sound field verification confirms the ranges to Level A harassment and Level B harassment isopleths are less than or equal to those modeled, assuming 10-dB attenuation, SouthCoast will be required to expand the minimum visibility, clearance, and/or shutdown zones. In the event that noise attenuation measures and/or adjustments to pile driving cannot reduce the distances to less than or equal to those modeled assuming 10 dB attenuation, this may indicate that the amount or extent of taking specified in the incidental take statement has been exceeded or be considered new information that reveals effects of the action that may affect listed species in a manner or to an extent not previously considered and reinitiation of this consultation is expected to be necessary. (50 CFR 402.16).

Clearance and Shutdown Requirements
As described in Section 3.0 *Description of the Proposed Action*, SouthCoast proposed as part of the COP and BOEM and NMFS OPR are requiring through conditions of COP approval and the proposed ITR respectively, monitoring of clearance and shutdown zones before, during, and after pile driving with detections of animals within these zones triggering a delay or shutdown of pile driving. In addition to the clearance and shutdown zones, NMFS OPR also identifies required minimum visibility zones for pile driving of WTG and OSP foundations (Table 7.1.22). The minimum visibility zones are the distances from the pile that the visual observers must be able to effectively monitor for marine mammals; that is, lighting, weather (e.g., rain, fog, etc.), and sea state must be sufficient for the observer to be able to detect a marine mammal within that distance from the pile. Outside the NARW EMA, these visibility distances are equivalent to the baleen whale clearance zone for impact pile driving and range from 2,300 to 4,100 m. Within the NARW EMA, they are 4,800 m for pin piles and 7,400 m for monopiles. As explained in the MMPA Proposed Rule, in the NARW EMA these values correspond to the seasonally-specific modeled distance to the 160 dB behavioral disturbance threshold; outside the NARW EMA, these distances correspond to the second largest modeled ER_{95}% distance to the onset of acoustic injury (PTS) isopleth (assuming 10 dB attenuation) among all marine mammals, rounded up to the closest 0.1 km and exceed the maximum ER95% distances to the onset of acoustic injury (PTS) isopleths for all ESA listed whales, expect fin whales.

The clearance zone is the area around the pile that must be declared “clear” of marine mammals and sea turtles prior to the activity commencing. The size of the zone is measured as the radius with the impact activity (i.e., pile) at the center. For marine mammals, both visual observers and passive acoustic monitoring (PAM, which detects the sound of vocalizing marine mammals) will be used; the area is determined to be “cleared” when visual observers have determined there have been no sightings of marine mammals in the identified area for a prescribed amount of time and, for North Atlantic right whales, if no right whales have been visually observed within or beyond the minimum clearance zone. For example, if a right whale is observed at a distance of 6 km from a monopile that is ready to be installed with an impact hammer, pile driving would be delayed (noting the maximum clearance zone for other baleen whales is 4 km). Further, the PAM operator will declare an area “clear” if they do not detect the sound of vocalizing right whales within the identified PAM clearance zone (10 km for pin piles, 15 km for monopiles) for the identified amount of time. The proposed ITR requires that the PAM monitoring system be capable of detecting vocalizing North Atlantic right whales within 15 km of the pile. Pile driving cannot commence until all of these clearances are made. As required by the proposed ITR, within the NARW EMA August 1- October 15 and throughout the Lease Area May 16-31 and December 1-31, for any acoustic detection within the North Atlantic right whale PAM clearance and shutdown zones or sighting of 1 or 2 North Atlantic right whales, SouthCoast Wind must delay commencement of or shutdown pile driving for 24 hours. For any sighting of 3 or more North Atlantic right whales, SouthCoast Wind must delay commencement of or shutdown pile driving for 48 hours. Prior to beginning clearance at the pile driving location after these periods, SouthCoast must conduct a vessel-based survey to visually clear the 10-km zone, if installing pin piles that day, or 15-km zone, if installing monopiles.

Once pile driving begins, the shutdown requirements apply. If a marine mammal is observed by a visual PSO entering or within the shutdown zone after pile driving has commenced, an immediate shutdown of pile driving will be implemented unless SouthCoast and/or its contractor determines shutdown is not feasible due to an imminent risk of injury or loss of life to an individual or risk of damage to a vessel that creates risk of injury or loss of life for individuals (see Section 3.0 for more information); in such instances, which are expected to be rare, hammer energy will be reduced to allow for safe installation of the pile to continue. For right whales, shutdown is also triggered by: the visual PSO observing a right whale at any distance (i.e., even if it is outside the shutdown zone identified for other whale species), and a detection by the PAM operator of a vocalizing right whale at a distance determined to be within the identified PAM shutdown zone (10 km for a pin pile, 15 km for monopile). The shutdown zone is larger than the modeled distances to the ER95% for the cumulative onset of acoustic injury (PTS) threshold (see Tables above) for all ESA listed whale species for all daily pile installation scenarios, with the exception of fin whales. Outside the NARW EMA, the shutdown zone is smaller than the modeled distance to the behavioral disturbance threshold for all installation scenarios (see Tables above). For right whales, considering just the minimum visibility distance that PSOs are expected to be able to monitor in all conditions, the minimum shutdown zone monitored by visual PSOs is larger than the modeled distance to the ER95% for the auditory injury (PTS) cumulative threshold (compare the distances in Table 7.1.22 to the tables above).

Table 7.1.22. Required Clearance and Shutdown Zones for Foundation Pile Driving. These are the PAM detection, minimal visibility, clearance and shutdown zones incorporated into the proposed action. Pile driving will not proceed unless the visual PSOs can effectively monitor the full extent of the minimum visibility zones. Detection (visual or PAM) of an animal within the clearance zone triggers a delay of initiation of pile driving; detection (visual or PAM) of an animal in the shutdown zone triggers the identified shutdown requirements.

Installation Order	Sequential						Concurrent	
Pile type	9/16-m Monopile	4.5-m Pin pile	9/16-m Monopile		4.5-m Pin Pile		1 WTG Monopile + 4 OSP pin piles	4 WTG pin +4 OSP pin piles
Method	Impact only		Impact	Vibe	Impact	Vibe	Impact	
North Atlantic right whale Visual	Sighting at Any Distance from PSOs on Pile-Driving or Dedicated PSO Vessels triggers a delay or shutdown (minimum visibility zone plus any additional distances observable by the visual PSOs on any PSO platform).							

Clearance/Shutdown Zone								
North Atlantic right whale PAM[1] Clearance/Shutdown Zone[1]	10,000 m (pin), 15,000 m (monopile)							
Other baleen whales Clearance/Shutdown Zone[1] (winter)	4,000 (4,100)	2,300 (2,700)	4,200	400	2,300	NAS[2]	4,000	3,000
Sperm whales Visual Clearance/Shutdown Zone[1]	NAS	NAS	NAS	NAS	NAS	NAS	NAS	NAS
Minimum Visibility Zone[2]	Within NARW EMA Enhanced: 4,800 m (pin) 7,400 m (mono) Outside NARW EMA: equal to 'other baleen whales' impact pile driving clearance zones							

NAS = noise attenuation system (e.g., double bubble curtain (DBBC)). This zone size designation indicates that the clearance and shutdown zones, based on modeled distances to the Level A harassment thresholds, would not extend beyond the DBBC deployment radius around the pile.
1 – The PAM system used during clearance and shutdown must be designed to detect marine mammal vocalizations, maximize baleen whale detections, and must be capable of detecting North Atlantic right whales at 10 km (6.2 mi) and 15 km (9.3 mi) for pin piles and monopile installations, respectively. NMFS recognizes that detectability of each species' vocalizations will vary based on vocalization characteristics (e.g., frequency content, source level), acoustic propagation conditions, and competing noise sources), such that other marine mammal species (*e.g.*, harbor porpoise) may not be detected at 10 km (6.2 mi) or 15 km (9.3 mi).
2 - PSOs must be able to visually monitor minimum visibility zones. To provide enhanced protection of North Atlantic right whales during foundation installations in the NARW EMA, SouthCoast proposed monitoring of minimum visibility zones equal to the Level B harassment zones when installing pin piles (4.8 km (3.0 mi)) and monopiles (7.4 km (4.6 mi)). Outside the NARW EMA, the minimum visibility zone would be equal to SouthCoast's clearance/shutdown zones for impact pile driving for 'other baleen whales.'
source: Table 54 in 89 FR 53708, updated in NMFS OPR's November 1 memo

The clearance and shutdown zones will be monitored by trained, independent PSOs. All distances to the edge of clearance and shutdown zones are the radius from the center of the pile. Concurrently, at least one PAM operator would be actively monitoring for marine mammals detections before, during, and after pile driving (more information on PAM is provided below). PSOs would visually monitor for marine mammals for a minimum of 60 minutes prior to pile driving beginning while PAM operators would review data from at least 24 hours prior to pile driving and actively monitor hydrophones for 60 minutes prior to pile driving. The PSOs would be required to maintain watch at all times when impact pile driving is underway. Per the conditions of the proposed ITR, each monitoring platform must have at least three on-duty PSOs; PSOs must be located on the pile driving vessel as well as on a minimum of three PSO-dedicated vessels inside the NARW EMA June 1 through July 31 and outside the NARW EMA June 1 through November 30; and, a minimum of four PSO-dedicated vessels within the NARW EMA

August 1-October 15 and throughout the Lease Area May 16-31 and December 1-31. The dedicated PSO vessels would be located at a distance to ensure effective monitoring of the entirety of the clearance zone. These requirements result in a total of at least 12 dedicated, third-party PSOs on duty at all times during pile driving, with at least 15 for pile driving in the NARW EMA.

Monitoring of the clearance and shutdown zones by PSOs at the stationary platform and PSO vessels will be supplemented by real-time passive acoustic monitoring (PAM). PAM systems are designed to detect the vocalizations of marine mammals, allowing for detection of the presence of whales underwater or outside of the range where a visual observer may be able to detect the animals. Monitoring with PAM not only allows for potential documentation of any whales exposed to noise above thresholds of concern that were not detected by the visual PSOs but also allows for greater awareness of the presence of whales in the project area as a larger area can be monitored (in this case, extending 10 to 15 km from the pile being driven, depending on pile type). As with the monitoring data collected by the visual PSOs, this information can be used to plan the pile driving schedule to minimize pile driving at times when whales are nearby and may be at risk of exposure to pile driving noise. As described in the proposed ITR, SouthCoast will be required to deploy a PAM system that must be able to detect marine mammal vocalizations, maximize baleen whale detections, and detect North Atlantic right whale vocalizations up to a distance of 10 km and 15 km during pin pile and monopile installation, respectively. As noted in the Proposed Rule, SouthCoast is required to describe the PAM system and its operation in a PAM Plan that must be submitted for review and approval by NMFS OPR prior to deployment. The PAM plan must include a description of all proposed PAM equipment, address how the proposed passive acoustic monitoring will follow standardized measurement, processing methods, reporting metrics, and metadata standards for offshore wind as described in *NOAA and BOEM Minimum Recommendations for Use of Passive Acoustic Listening Systems in Offshore Wind Energy Development Monitoring and Mitigation Programs* (Van Parijs *et al.*, 2021). With these requirements in place, we anticipate that use of PAM will be highly effective at detecting vocalizing marine mammals within the identified PAM monitoring zone (10 or 15 km depending on pile type), which will enhance the detection capabilities of the PSOs and increase the effectiveness of the clearance (and shutdown) requirements. If the PAM operator detects a right whale vocalization confirmed or suspected to be within the PAM clearance zone (10 or 15 km; the area that the PAM system will need to be able to effectively monitor for vocalizing right whales), the associated clearance or shutdown procedures must be implemented (i.e., delay or stop pile driving). As described in the proposed ITR, in the event that a large whale is acoustically detected that cannot be confirmed as a non-North Atlantic right whale, it must be treated as if it were a right whale for purposes of mitigation. More details on PAM operator training and PAM protocols are included in the Proposed Rule and the draft LOA.

All clearance zones must be confirmed to be free of marine mammals for 30 minutes immediately prior to the beginning of soft-start procedures or vibratory pile driving. For blue, fin, sei, and sperm whales, this means that the PSOs have not seen any individuals within the clearance zone during that period. For right whales, this means that the PSOs have not seen any right whales in the baleen whale clearance zone plus any additional distance that they can see beyond that area. Given the minimum visibility requirements, we expect that this means that the PSOs will be able to detect a large whale at the surface anywhere within the full extent of the minimum visibility zone. Similarly, the PAM operator must confirm that there have been no detections of vocalizing right whales in the PAM clearance zone (extending 10 km from a pin pile or 15 km from a monopile) for the preceding 60 minutes. If any visual PSO observes a marine mammal entering or within the relevant clearance zone, or the PAM operator detects a right whale within the PAM clearance zone prior to the initiation of pile driving activities, pile driving must be delayed and will not begin until either the marine mammal(s) has voluntarily left the clearance zone and has been visually or acoustically confirmed beyond that clearance zone, or, when 30 minutes have elapsed with no further sightings or acoustic detections. Pile driving must only commence when lighting, weather (e.g., rain, fog, etc.), and sea state have been sufficient for the observer to be able to detect a marine mammal within the identified minimum visibility distances for at least 30 minutes (i.e., clearance zone is fully visible for at least 30 minutes). Within the NARW EMA (August 1- October 15) and throughout the Lease Area from May 16-31 and December 1-31, for any acoustic detection within the North Atlantic right whale PAM clearance zones or sighting of 1 or 2 North Atlantic right whales, SouthCoast Wind must delay commencement of pile driving for 24 hours. For any sighting of 3 or more North Atlantic right whales, SouthCoast Wind must delay commencement of pile driving for 48 hours. Prior to beginning clearance at the pile driving location after these periods, SouthCoast must conduct a vessel-based survey to visually clear the 10-km (6.2-mi) zone, if installing pin piles that day, or 15-km (9.32- mi) zone, if installing monopiles. As required by the proposed ITR, any large whale sighted by a PSO or acoustically detected by a PAM operator that cannot be identified as a species other than a North Atlantic right whale must be treated as if it were a North Atlantic right whale.

The requirement for the minimum visibility zones for foundation pile driving and the requirement that at least 12 PSOs be working from at least four platforms (3 PSOs at the pile driving platform, 3 on each of at least three dedicated-PSO vessels located at a distance from the pile, plus an additional vessel in some locations/times of year), make it reasonable to expect that the full extent of the clearance zones will be effectively monitored and that large whales within this area will be detected by at least one of the PSOs. The use of PAM will further enhance the ability of the visual PSOs to detect whales within the clearance zone. The clearance zones may only be declared clear, and pile driving started, when the full extent of all clearance zones are visible (i.e., when not obscured by dark, rain, fog, etc.) for a full 30 minutes prior to pile driving and the PAM operator has made the required clearances based on detection of vocalizing whales. With these measures in place, we expect that the clearance requirements will be effective and that it is extremely unlikely that pile driving would begin with an ESA listed whale present within the clearance zone for any foundation installation.

Once pile driving begins, the shutdown requirements apply. The purpose of a shutdown is to prevent a specific acute impact, such as auditory injury or severe behavioral disturbance of sensitive species, by halting the activity. If an ESA-listed whale is observed entering or within the identified shutdown zone (see Table 7.1.22) after pile driving has begun, a shutdown must be called for. For North Atlantic right whales, any visual observation by a PSO at any distance, or acoustic detection within the 10-km (pin pile) and 15-km (monopile) PAM clearance and shutdown zones will trigger shutdown of pile driving. Within the NARW EMA (August 1- October 15) and throughout the Lease Area from May 16-31 and December 1-31, for any acoustic detection within the North Atlantic right whale PAM clearance and shutdown zones or sighting of 1 or 2 North Atlantic right whales, SouthCoast Wind must shutdown pile driving for 24 hours. For any sighting of 3 or more North Atlantic right whales, SouthCoast Wind must shutdown pile driving for 48 hours. Prior to beginning clearance at the pile driving location after these periods, SouthCoast must conduct a vessel-based survey to visually clear the 10-km (6.2-mi) zone, if installing pin piles that day, or 15-km (9.32- mi) zone, if installing monopiles. Outside of these areas/times, if pile driving has been shut down due to the presence of a North Atlantic right whale, pile driving may not restart until the North Atlantic right whale is no longer observed or 30 minutes has elapsed since the last detection. Upon re-starting pile driving, soft start protocols must be followed (i.e., reduced hammer energy for at least 20 minutes).

In situations when shutdown is called for but SouthCoast determines shutdown is not feasible due to imminent risk of injury or loss of life to an individual, or risk of damage to a vessel that creates risk of injury or loss of life for individuals, reduced hammer energy must be implemented. As described in Section 3.3, in rare instances, shutdown may not be feasible, as shutdown would result in a risk to human life. Specifically, pile refusal or pile instability could result in not being able to shut down pile driving immediately. Pile refusal occurs when the pile driving sensors indicate the pile is approaching refusal (i.e., the limits of installation), and a shutdown would lead to a stuck pile which then poses an imminent risk of injury or loss of life to an individual, or risk of damage to a vessel that creates risk for individuals. Pile instability occurs when the pile is unstable and unable to stay standing if the piling vessel were to “let go.” During these periods of instability, the lead engineer may determine a shut-down is not feasible because the shut-down combined with impending weather conditions may require the piling vessel to “let go,” which then poses an imminent risk of injury or loss of life to an individual, or risk of damage to a vessel that creates risk for individuals as it means the pile would be released while unstable and could fall over. As explained in Section 3.0 *Description of the Proposed Action* and above, the likelihood of shutdown being called for and not implemented is considered very low. If shutdown cannot occur without an unacceptable risk to safety, hammer energy must be reduced to the lowest level that allows safe installation and pile stability. After shutdown, pile driving may be restarted once all clearance zones are clear of marine mammals for the minimum species-specific periods, with the required soft-start measures.

Consistent with the requirements of the proposed ITR and COP approval, absent an approved nighttime pile driving monitoring plan (which to date has not been submitted for review), the time of day when pile driving can begin is limited to daytime, which is defined as being between one hour after civil sunrise and 1.5 hours before civil sunset. Pile driving may not be initiated any later than 1.5 hours before civil sunset and may continue after dark only when the installation of that pile began during daylight hours. Pile driving may continue after dark only when: the driving of the same foundation began during the day when clearance zones were fully visible; it was anticipated that foundation installation could be completed before sundown; and, foundation installation must proceed for human safety or installation feasibility reasons (e.g., stopping would result in pile refusal or pile instability that would risk human life or safety). In such cases, monitoring must be carried out consistent with an approved monitoring plan for low visibility conditions. Given that the time to install the pile is expected to be predictable, we expect these instances of pile installation taking longer than anticipated to be very rare.

As described above, unless a nighttime monitoring plan is approved by BOEM, NMFS OPR, and NMFS GARFO and that plan demonstrates that PSOs working at night can observe the clearance and shutdown zones in a way that would allow for effective implementation of the clearance and shutdown requirements (i.e., such that effects of pile driving would be the same at night as they were during the day), pile driving would not be initiated at night. Even with an approved night time monitoring plan, pile driving will not proceed when conditions prevent the full extent of all relevant clearance zones to be confirmed to be clear of marine mammals, as determined by the lead PSO on duty. We also note that the minimum visibility requirements would be in effect for night time pile driving. As the minimum visibility, clearance, and shutdown requirements are the same, this effects analysis is based on the requirement that any approval of a nighttime foundation installation plan will be based on the ability to effectively monitor the clearance and shutdown zones after dark and that there would be no different risk of exposure or different effects for pile driving initiated after dark. We also note that review and approval of a low visibility/alternative monitoring plan is required prior to any foundation installation activities; this will be designed to ensure that monitoring can be effective when visibility conditions change during pile driving (e.g., unexpected fog).

Soft Start
As described in the MMPA Proposed Rule, the use of a soft start procedure is expected to provide additional protection to marine mammals by warning marine mammals or providing them with a chance to leave the area prior to the hammer operating at full capacity, and typically involves a requirement to initiate sound from the hammer at reduced energy followed by a waiting period. As described in the MMPA Proposed Rule, SouthCoast will utilize soft start techniques for impact pile driving including by operating at reduced hammer energy for a minimum of 20 minutes. Soft start, which we consider part of the proposed action, would be required at the beginning of each day’s impact pile driving work and at any time following a cessation of impact pile driving of thirty minutes or longer. Without soft start procedures, pile driving would begin with full hammer energy, which would present a greater risk of more severe impacts to more animals. In this context, soft start is a mitigation measure designed to reduce the amount and severity of effects incidental to pile driving.

Use of a soft start can reduce the cumulative sound exposure if animals respond to a stationary sound source by swimming away from the source quickly (Ainslie et al. 2017). The result of the soft start will be an increase in underwater noise in an area radiating from the pile that is expected to exceed the relevant behavioral disturbance threshold and, therefore, is expected to cause any whales exposed to the noise to swim away from the source. The use of the soft start gives whales near enough to the piles to be exposed to the soft start noise a “head start” on escape or avoidance behavior by causing them to swim away from the source. Through use of soft start, marine mammals are expected to move away from a sound source that is annoying, thereby avoiding exposure resulting in a serious injury and avoiding sound sources at levels that would cause hearing loss (Southall et al. 2008, Southall et al. 2016). It is possible that some whales may swim out of the noisy area before full force pile driving begins; in this case, the risk of whales being exposed to noise that exceeds the cumulative onset of auditory injury threshold would be reduced. It is likely that by eliciting avoidance behavior prior to full power pile driving, the soft start will reduce the duration of exposure to noise that could result in auditory injury, TTS, or behavioral disturbance. However, we are not able to predict the extent to which the soft start will reduce the number of whales exposed to pile driving noise or the extent to which it will reduce the duration of exposure. Therefore, while the soft start is expected to reduce effects of pile driving, we are not able to modify the estimated take numbers to account for any benefit provided by the soft start.

Consideration of the Effectiveness of the Mitigation Measures to Reduce Exposure to Noise above the Onset of Auditory Injury and Behavioral Disturbance Thresholds
As described in the Proposed Rule, given the qualities of vibratory pile driving noise (*i.e.*., continuous, lower hammer energy), auditory injury (Level A harassment, PTS) is not an anticipated impact on marine mammals incidental to vibratory pile setting; however, exposure to vibratory pile setting noise is incorporated into the consideration of distances to the cumulative auditory injury threshold for scenarios where both vibratory pile setting and impact pile driving are considered (Project 2 only). Modeling indicates that noise above the peak onset of auditory injury threshold extends only 130 to 270 m from the pile being installed, depending on pile type and time of year (see Table 15 in the Proposed Rule). Given the requirements for clearance and shutdown cover much larger areas, we consider that the mitigation measures that are part of the proposed action will be effective at reducing the potential for exposure of any ESA listed whales to noise above the peak onset of injury threshold such that such exposure to a single pile strike that could result in PTS is extremely unlikely to occur. This is consistent with the conclusions reached in the Proposed Rule and in BOEM's BA.

No exposure of sperm whales that could result in PTS is expected based on the distance to the onset of acoustic injury (PTS) threshold for mid-frequency cetaceans not being exceeded; as such, we consider such exposure to be extremely unlikely to occur and do not expect any sperm whales to be exposed to any noise above the onset of injury threshold and find that PTS for any sperm whales is extremely unlikely to occur.

Modeling predicted the exposure of a number of right, sei, and fin whales to noise above the cumulative onset of acoustic injury (PTS) threshold (see Tables 7.1.16-20). Considering all foundation types and installation scenarios, the required clearance zone is larger than the exposure range to the onset of auditory injury cumulative threshold for all pile driving scenarios for right and sei whales; this is the case even considering only the "baleen whale" clearance zone and not any further distance that a PSO may be able to see right whales and trigger a delay of pile driving and not accounting for the PAM clearance zone. Pile driving cannot begin if a whale is detected by the visual PSOs within the clearance zone. As explained above, considering the minimum visibility requirements and placement of at least 12 visual PSOs on at least 4 platforms (3 each at the pile driving platform and on at least three vessels, with an additional vessel required in some locations/times of year), we expect that the full extent of the clearance zone will be able to be effectively monitored by the visual PSOs. Given the minimum visibility requirements and the ability of the PSOs to monitor the entirety of the clearance zone, and the additional detection ability provided by the PAM system, it is unlikely that any pile driving would begin with a right or sei whale within the clearance zone. Similarly, the shutdown zone is larger than the exposure range to the onset of auditory injury cumulative threshold for all pile driving scenarios for right and sei whales; this is the case even considering only the "baleen whale" shutdown zone and not any further distance that a PSO may be able to see right whales and trigger a delay of pile driving and not accounting for the PAM clearance zone. As explained above, we expect that when called for, shutdown of pile driving will be implemented with very limited and rare exceptions. In those cases, reduced hammer energy will be implemented. This is designed to ensure that in those instances when shutdown would create a risk to human life, pile installation can continue to a safe point while also ensuring that a right or sei whale is not exposed to noise above the cumulative onset of auditory injury threshold. Based on these considerations, we consider that the mitigation measures that are part of the proposed action will be effective at reducing the potential for exposure of any sei whales to noise above the cumulative onset of auditory injury threshold such that such exposure to pile driving noise that could result in PTS is extremely unlikely to occur. This is consistent with the conclusions reached in the Proposed Rule and in BOEM's BA.

Modeling predicts the exposure of up to 8 right whales to noise above the cumulative onset of auditory injury threshold over the entire duration of all impact pile driving for foundation installation (Tables 7.1.16-20). The model does not consider the pre-start clearance or shutdown requirements or any aversion (avoidance) behavior of right whales. The proposed action incorporates measures to reduce the risk of exposure to noise that could result in PTS for right whales. The best available data provides NMFS confidence that North Atlantic right whales are expected in the WDA predominantly from January – April (Roberts et al. 2024), with the highest density months outside of that period being May and December. Due to this seasonal pattern in North Atlantic right whale occurrence in the project area, we expect the most significant measure to minimize impacts to North Atlantic right whales are the time of year restrictions; however, we note that these seasonal restrictions are already factored into the exposure estimate.

As explained above, we expect the clearance and shutdown requirements to be highly effective. As noted above, the visual clearance zones, even just considering the minimum visibility distances required by BOEM and NMFS OPR, and part of the proposed action, are larger than the distance to the onset of auditory injury threshold (compare the distances in Tables 7.1.16-20 to the minimum visibility zones in 7.1.22) as is the PAM clearance zone (10 km or 15 km depending on pile type). Pile driving cannot begin if a right whale is detected via PAM within 10 or 15 km of the pile or is detected by the visual PSOs at any distance from the pile to be driven. The baleen whale clearance zone and the minimum visibility requirement exceed the distance to the CPA for the cumulative onset of auditory injury threshold for right whales in every pile installation scenario. Considering placement of three visual PSOs at the pile driving platform and three PSOs on each of three vessels (or four when pile driving occurs within the NARW EMA or outside the EMA in May or December) located at a distance away from the pile being driven to maximize coverage of the clearance zones, we expect that an area that well exceeds the cumulative onset of auditory injury CPA will be able to be effectively monitored for right whales by the visual PSOs. Thus, the area that we expect can be effectively monitored by the visual PSOs is larger than the area where noise will be above the onset of auditory injury cumulative noise threshold. Visual monitoring will be supplemented by PAM, which has the potential to detect vocalizing right whales that are too far away to be seen by the visual observer or that are submerged; a PAM system will be deployed to detect vocalizations from right whales within 10 km of any pin pile and 15 km for any monopile. As noted above, pile driving will not begin if the PSOs detect a right whale within any distance from the pile (i.e., even if it is further away than the onset of auditory injury threshold distance) or if a right whale is detected via PAM within 10 or 15 km of a pin pile or monopile, respectively. We expect that these measures in combination with the requirements for monitoring North Atlantic right whale sightings reports, which increases awareness of potential North Atlantic right whales in the WDA, and the low density of right whales in the WDA when pile driving could occur make it extremely unlikely that pile driving would begin with a right whale in the clearance zone.

Shutdown is required if a PSO observes a right whale at any distance from the pile being driven or if a whale cannot be detected to species. Additionally, shutdown is required if a right whale is detected via PAM within any distance from the pile being driven. As explained above and detailed in Section 3.0 *Description of the Proposed Action*, instances where a shutdown is called for and is not able to be implemented are expected to be very rare. Together, we expect the use of PAM combined with the requirement for at least 12 visual PSOs stationed on at least four platforms to be able to effectively monitor the clearance zone before pile driving and the shutdown zone during pile driving in a way that is expected to prevent pile driving from occurring if a right whale is close enough to pile driving such that exposure to noise above the onset of auditory injury threshold would occur. In the unanticipated event that a right whale swims towards a pile during pile driving, it is expected that it would be detected prior to getting close enough to be exposed to noise above the onset of auditory injury threshold; it is expected that pile driving will be stopped upon that detection and not re-started until the right whale has left the clearance zone. This would prevent the right whale from being close enough to the pile driving for long enough to exceed the onset of auditory injury (cumulative) harassment threshold. In the event that shutdown cannot occur (i.e., to prevent imminent risk of injury or loss of life to an individual, or risk of damage to a vessel that creates risk for individuals), the energy that the pile driver operates at will be reduced. The lower energy results in less noise and shorter distances to thresholds. The slow swim speed of right whales makes it extremely unlikely that lower hammer energy could not be enacted before the whale reached the CPA for onset of auditory injury which modeling indicates would mean the individual had accumulated enough noise exposure to have experienced PTS. As such, even if shutdown cannot occur, we do not expect that a right whale would remain close enough to the pile being driven for a long enough period to be exposed to noise above the onset of auditory injury threshold and experience PTS. We expect that these measures in combination with the requirements for monitoring North Atlantic right whale sightings reports for surrounding areas daily, which increases awareness of potential North Atlantic right whales in the WDA, and the low density of right whales in the WDA when pile driving could occur make it extremely unlikely that any of the modeled exposure to noise above the onset of auditory injury, which already was small (fewer than 18 individuals over the entirety of pile driving), will occur. As a result of these mitigation measures, and in light of our independent review, we agree with BOEM's and NMFS OPR's determinations that the already small potential for North Atlantic right whales to be exposed to project-related sound above the onset of auditory injury harassment threshold is extremely unlikely to occur. As such, as stated above, it is extremely unlikely that any right whales will experience permanent threshold shift or any other injury as a result of exposure to pile driving noise.

As explained above, for some pile driving scenarios, the clearance and shutdown zone is 15-20% smaller than the CPA for fin whales onset of auditory injury; this means that a fin whale could occur outside the clearance/shutdown zone and be exposed to noise that modeling predicts would indicate the animal would experience PTS. As explained above, this was factored into

SouthCoast's request for authorization for 20% of the amount of modeled exposures of fin whales to noise above the onset of auditory injury threshold and NMFS OPR's proposed authorization for that amount of incidental take under the MMPA. Because the requirements to delay or shutdown pile driving for animals detected outside the baleen whale clearance zone only applies to right whales, we can not discount the possibility that pile driving would begin or continue with a fin whale outside the clearance/shutdown zone but close enough such that it may accumulate enough noise exposure to experience PTS. We also note that the swim speeds of fin whales (which are considerably faster than right whales – right whale maximum swim speed is around 9 km/h while the burst swim speed of fin whales is up to 47 km/h), and their deep and lengthy dives (which reduces surface time), may make detection of fin whales more difficult than other whale species. Although we expect that individuals will temporarily avoid the area during the foundation installation activities, and that monitoring of the clearance zone will be effective at reducing the potential for pile driving to start with a fin whale in the clearance zone, given the factors outlined above, we cannot discount the potential for a fin whale to transit outside the clearance or shutdown zone close enough to the pile being driven such that they are exposed to noise above the onset of auditory injury threshold.

As explained above, the modeling carried out for the MMPA ITA application predicts the exposure of up to 15 fin whales to noise above the onset of auditory injury threshold. As explained in the MMPA Proposed Rule and summarized above, NMFS OPR determined it was unlikely that all fin whale exposures estimated by modeling would actually occur, and, in consideration of the size of the clearance and shutdown zones and the expected effectiveness of the required mitigation measures, is proposing to authorize 20 percent of the model-estimated Level A harassment (PTS) (7). We have reviewed NMFS OPR's assessment as presented in the MMPA Proposed Rule and agree that given the factors identified above related to the shutdown of pile driving, we cannot discount all of the anticipated exposures of fin whales above the onset of auditory injury criteria and we agree that OPR's estimates are reasonable. Therefore, we consider that up to 7 fin whales may be exposed to noise above the onset of auditory injury threshold and experience PTS as a result of exposure to pile driving noise.

In all foundation installation scenarios, the area where a blue, fin, sei, or sperm whale would be expected to be exposed to noise above the relevant behavioral disturbance threshold (CPA) is outside the clearance and shutdown zone. Considering right whales, within the NARW EMA from August 1-October 15 and outside the NARW EMA from May 16-31 and December 1-31, the minimum visibility zone sizes would be set equal to the largest Level B harassment zone (unweighted acoustic ranges to 160 dB re 1 μPa sound pressure level) modeled for each pile type, assuming 10 dB of noise attenuation, rounded up to the nearest 0.1 km (0.06 mi) (7.5 km (4.7 mi) monopiles; 4.9 km (3.0 mi) pin piles). For installations outside the NARW EMA from June 1-November 30, the minimum visibility zone is equal to the baleen whale clearance zone and would be smaller than the distance to the Level B harassment threshold. Given this, the clearance and shutdown procedures are not expected to eliminate the potential for exposure of blue, fin, sei, right, or sperm whales to noise above the Level B harassment threshold. Therefore, we cannot reduce or refine the take estimates based on the Level B harassment thresholds in consideration of the effectiveness of the clearance zone. As such, consistent with the Proposed Rule, we expect that up to 2 blue, 520 fin, 109 right, 47 sei, and 135 sperm whales may be exposed to noise above the Level B threshold during the installation of foundations for SouthCoast projects 1 and 2. Effects to individuals from this exposure are addressed below.

<u>*Summary of Noise Exposure Anticipated as a Result of Foundation Pile Driving*</u>
In summary, we expect that no ESA listed whales will be exposed to noise above the peak onset of auditory injury threshold; up to 7 fin whales will be exposed to noise above the cumulative onset of auditory injury threshold, and up to 2 blue, 520 fin, 109 right, 47 sei, and 135 sperm whales will be exposed to noise above the behavioral disturbance threshold but below the onset of auditory injury threshold during all foundation pile driving. This is consistent with the numbers of Level A and Level B harassment takes proposed for authorization by NMFS OPR as a result of exposure to pile driving noise and consistent with the assessment in BOEM's BA. Below, we consider the effects of these noise exposures.

7.1.3.2 Effects to ESA-Listed Whales from Exposure to Pile Driving Noise

Effects of Exposure to Noise above the onset of auditory injury Threshold
As explained above, up to 7 fin whales are expected to be exposed to impact pile driving noise that is loud enough to result in auditory injury in the form of permanent threshold shift (PTS). Consistent with OPR's determination in the MMPA Proposed Rule, in consideration of the duration and intensity of noise exposure we expect that the consequences of exposures above the Level A harassment threshold would be in the form of PTS. PTS would consist of permanent minor degradation of hearing capabilities occurring predominantly at frequencies one-half to one octave above the frequency of the energy produced by pile driving (*i.e*., the low-frequency region below 2 kHz) (Cody and Johnstone, 1981; McFadden, 1986; Finneran, 2015), not severe hearing impairment. If hearing impairment occurs, it is expected that the affected animal would permanently lose a few decibels in its hearing sensitivity, which is not likely to meaningfully affect its ability to perform essential behavioral functions, such as foraging, socializing, migrating and communicating with conspecifics, or detecting environmental cues, i.e. minor degradation of hearing capabilities within regions of hearing that align most completely with the energy produced by pile driving (i.e. the low-frequency region below 2 kHz), not severe hearing impairment. If hearing impairment occurs, it is most likely that the affected animal would lose a few decibels in its hearing sensitivity, which, given the limited impact to hearing sensitivity, is not likely to meaningfully affect its ability to forage and communicate with conspecifics. No severe hearing impairment or serious injury is expected because of the received levels of noise anticipated and the short duration of exposure. NMFS defines "harm" in the definition of ESA "take" as "an act which actually kills or injures fish or wildlife (50 CFR 222.102). Such an act may include significant habitat modification or degradation where it actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding or sheltering" (50 CFR §222.102). The PTS anticipated is considered a minor but permanent auditory injury and is considered harm in the context of the ESA definition of take.

The measures designed to minimize exposure, or effects of exposure, that are required by NMFS OPR through the terms of the proposed MMPA ITR and LOA, and by BOEM through the conditions of COP approval, and implemented by SouthCoast–all of which are considered elements of the proposed action–make it extremely unlikely that any whale will be exposed to pile driving noise that would result in severe hearing impairment or serious injury or mortality. Severe hearing impairment or serious injury would require both greater received levels of noise and longer duration of exposure than are anticipated to result from the SouthCoast pile driving. Together, the sound attenuation measures, clearance and shutdown requirements, and soft start limit the potential for exposure to noise that could result in severe hearing impairment or serious injury, making such exposure extremely unlikely to occur.

PTS is permanent, meaning the effects of PTS last well beyond the duration of the proposed action and outside of the action area as animals migrate. As such, PTS has the potential to affect aspects of the affected animal's life functions that do not overlap in time and space with the proposed action. The PTS anticipated is considered a minor auditory injury. With this minor degree of PTS, we do not expect it to affect any of any individuals' overall health, reproductive capacity, or survival. The up to 7 fin whales that experience PTS could be less efficient at locating conspecifics and/or have decreased ability to detect threats at long distances, but these animals are still expected to be able to locate conspecifics to socialize, forage and reproduce, and are expected to be able to detect threats with enough time to avoid injury or mortality resulting from those threats. While PTS may affect the ability of an individual to use acoustic cues to respond to threats or stressors, the effects are not expected to be so severe to actually increase the risk that a fin whale will be injured. That is, while PTS may affect the behavior of an affected fin or sei whale in a way that affects its ability to use acoustic cues to detect and respond to threats, we do not expect this response will be so impacted that it would actually result in a whale being hit by a vessel or becoming entangled in fishing gear or otherwise resulting in injury or mortality. For this reason, we do not anticipate that the instances of harm by PTS will result in any other injuries or any impacts on foraging or reproductive success, inclusive of mating, gestation, and nursing, or survival of any of the 6 fin whales that experience PTS.

Effects of Exposure to Noise above the behavioral disturbance threshold but Below the onset of auditory injury Threshold

Potential impacts associated with noise above the behavioral disturbance threshold threshold but below the onset of auditory injury threshold would include low-level, temporary behavioral modifications, most likely in the form of avoidance behavior or potential alteration of vocalizations, as well as potential Temporary Threshold Shift (TTS) and masking. The up to 2 blue, 520 fin, 109 right, 47 sei, and 135 sperm whales exposed to pile driving noise above the behavioral disturbance threshold but below the onset of auditory injury threshold are expected to experience TTS, behavioral disturbance, and masking.

An extensive discussion of TTS is presented in the MMPA Proposed Rule and is summarized here, with additional information presented in Southall et al. (2019) and NMFS 2018. TTS represents primarily tissue fatigue and is reversible (Henderson et al. 2008). In addition, investigators have suggested that TTS is within the normal bounds of physiological variability and tolerance and does not represent physical injury (*e.g.,* Ward, 1997; Southall *et al.,* 2019). Therefore, NMFS does not consider TTS, alone, to constitute auditory injury.

While experiencing TTS, the hearing threshold rises, and a sound must be at a higher level in order to be heard; that is, the animal experiences a temporary loss of hearing sensitivity. TTS, thus, is a temporary hearing impairment and can last from a few minutes to days, be of varying degree, and occur across different frequency bandwidths. All of these factors determine the severity of the impacts on the affected individual, which can range from minor to more severe. In many cases, hearing sensitivity recovers rapidly after exposure to the sound ends. Observations of captive odontocetes suggest that wild animals may have a mechanism to self-mitigate the impacts of noise exposure by dampening their hearing during prolonged exposures to loud sound, or if conditioned to anticipate intense sounds (Finneran, 2018, Nachtigall *et al.*, 2018).

Impact pile driving generates sounds in the lower frequency ranges (with most of the energy below 1-2 kHz but with a small amount energy ranging up to 20 kHz); therefore, in general and all else being equal, we would anticipate the potential for TTS as more likely to occur in frequency bands in which the animals communicate. However, we would not expect the TTS to span the entire communication or hearing range of any species, given the frequencies produced by pile driving do not span entire hearing ranges for any particular species. Additionally, though the frequency range of TTS that marine mammals might sustain would overlap with some of the frequency ranges of their vocalization types, the frequency range of TTS from SouthCoast's pile driving activities would not be expected to span the entire frequency range of one vocalization type, much less span all types of vocalizations or other critical auditory cues for any given species.

Generally, both the degree of TTS and the duration of TTS would be greater if the marine mammal is exposed to a higher level of energy (which would occur when the peak dB level is higher or the duration is longer). Source level alone is not a predictor of TTS. An animal would have to approach closer to the source or remain in the vicinity of the sound source appreciably longer to increase the received SEL, which would be difficult considering the proposed mitigation and the anticipated movement of the animal relative to the stationary sources such as impact pile driving. The recovery time of TTS is also of importance when considering the potential impacts from TTS. In TTS laboratory studies--some using exposures of almost an hour in duration or up to 217 SEL--almost all individuals recovered within 1 day or less, often in minutes. We note that while the pile driving activities last for up to four hours for a single pile and up to 12 hours a day, it is unlikely that ESA listed whales would stay in the close proximity to the source long enough to incur more severe TTS (see additional explanation below regarding anticipated duration of exposure). Overall, given that we do not expect an individual to experience TTS from pile driving on more than one day, the low degree of TTS, and the short anticipated duration of exposure (no more than a few hours), and that it is extremely unlikely that any TTS will overlap the entirety of a critical hearing range, we expect that, consistent with the literature cited above, the effects of TTS and any behavioral response resulting from this TTS will be limited to minutes to hours from the time of exposure. Effects of TTS resulting from exposure to SouthCoast project noise are addressed more fully below.

In order to evaluate whether or not individual behavioral responses, in combination with other stressors, impact animal populations, scientists have developed theoretical frameworks that can then be applied to particular case studies when the supporting data are available. One such framework is the population consequences of disturbance model (PCoD), which attempts to assess the combined effects of individual animal exposures to stressors at the population level (NAS 2017). Nearly all PCoD studies and experts agree that infrequent exposures of a single day or less are unlikely to impact individual fitness, let alone lead to population level effects (Booth et al. 2016; Booth et al. 2017; Christiansen and Lusseau 2015; Farmer et al. 2018; Harris et al. 2017; Harwood and Booth 2016; King et al. 2015; McHuron et al. 2018; NAS 2017; New et al. 2014; Pirotta et al. 2018; Southall et al. 2008; Villegas-Amtmann et al. 2015).

Since we expect that any exposures to disturbing levels of noise would be limited to less than a day (limited only to the time it takes to swim out of the area with noise above the behavioral disturbance threshold but never more than the up to 12 hours that pile driving would occur in a single day – the active pile driving time for 4 pin piles installed with vibratory and impact hammers), with repeat exposures to the same individuals unlikely within a construction season (based on abundance, distribution and sightings data including that whales in the WDA are transient and not remaining in the area for extended periods during the pile driving windows), any behavioral responses that would occur due to animals being exposed to pile driving are expected to be temporary, with behavior returning to a baseline state shortly after the acoustic stimuli ceases (i.e., pile driving stops or the animal swims far enough away from the source to no longer be exposed to disturbing levels of noise). Given this, and our evaluation of the available PCoD studies, this infrequent, time-limited exposure of individuals to pile driving noise is unlikely to impact the fitness of any individual; that is, the anticipated disturbance is not expected to impact individual animals' health or have effects on individual animals' survival or reproduction. Specific effects to the different species are considered below.

North Atlantic Right Whales

Based on the modeling carried out for the project, we expect that up to 109 North Atlantic right whales may experience TTS and/or behavioral disturbance from exposure to pile driving noise. These exposures will occur across the two Projects. We do not expect repeat exposures within a construction season (i.e., the same individual exposed to multiple pile driving events) due to the short duration and intermittent natures of the pile driving noise and the limited residence time and transient nature of right whales in the area during the period when pile driving would occur. That is, because right whales are not expected to stay in the WDA for any extended period of time during the pile driving windows (regardless of pile driving activity) we do not expect an individual to be present in the same portion of the WDA for multiple days such that it could be exposed to multiple pile driving events within the same construction season. During the time of year and locations where pile driving will occur, right whales are expected to be primarily migrating. At the times of year and locations where pile driving within the WDA may occur, regular or sustained foraging is not expected. The pile driving windows have been specifically designed to avoid the areas and times of year when right whales are present in the highest densities and to minimize the potential for disruption of foraging activity.

When in the portion of the action area where exposure to pile driving noise would occur (i.e., within the WDA during the time of year when pile driving may occur), the primary activity North Atlantic right whales are expected to be engaged in is migration; however, foraging, resting, and socializing also occur in the area (Quintana-Rizzo et al. 2021). If a North Atlantic right whale exhibited a behavioral response to the pile driving noise, the activity that the animal was carrying out would be disrupted, and it may pose some energetic cost; these effects are addressed below. Animals displaced from a particular portion of the area due to exposure to pile driving noise are expected to either return to the area after the noise stopped or continue their normal behaviors from the location they moved to; these effects are addressed below. As noted previously, responses to pile driving noise are anticipated to be short-term (less than a day).

Quintana-Rizzo et al. (2021) reported on observations of right whales in the MA/RI and MA Wind Energy Areas. Feeding was recorded on more occasions (n = 190 occasions) than socializing (n = 59 occasions). Feeding was observed in all seasons and years, whereas social behaviors were observed mainly in the winter and spring and were not observed in 2011 and 2017. No pile driving will occur in the majority of months defined in that paper as winter (December – February) and spring (March – May); given that social behavior is limited in the time of year that pile driving is proposed (May-December), the potential for effects to social behavior is very low. However, even if a whale was engaged in social behavior when pile driving commenced, any disruption is limited to no more than the four to 12 hours it would take to complete pile driving for a single foundation. As explained above, social behavior is not necessarily indicative of mating and there is currently no evidence of mating behavior in the lease area. However, even if mating does occur in the lease area we would expect it to occur in the winter months when pile driving will not occur. Therefore, disruption of mating is extremely unlikely to occur.

Right whales are considerably slower than the other whale species in the action area, with maximum speeds of about 9 kilometers per hour (kph). Hatin et al. (2013) report median swim speeds of singles, non mother-calf pairs, and mother-calf pairs in the southeastern United States recorded at 1.3 kph, with examples that suggest swim speeds differ between within-habitat movement and migration-mode travel (Hatin et al. 2013). Studies of marine mammal avoidance of sonar, which like pile driving is an impulsive sound source, demonstrate clear, strong, and pronounced behavioral changes, including sustained avoidance with associated energetic swimming and cessation of feeding behavior (Southall et al. 2016) suggesting that it is reasonable to assume that a whale exposed to noise above the behavioral disturbance threshold would take a direct path to get outside of the noisy area. During impact pile driving, the distance to the behavioral disturbance threshold (acoustic range; Table 17 in the Proposed Rule) extends up to 8.7 km for monopiles and up to 5.3 km for pin piles; given the expected duration of impact pile driving this noise would persist in the area for approximately 4 hours for a monopile and approximately 2.2 hours for a single pin pile (approximately 9 hours considering 4 pin piles installed in a day). During vibratory pile setting, the distance to the behavioral disturbance threshold is much larger (extending up to 84.7 km for monopiles and 22 km for pin piles); however, vibratory pile setting is only expected for about 20 minutes per monopile and 90 minutes per pin pile (followed by impact pile driving). Considering these distances and right whale swim speed, (median 1.3 kph, maximum 9 kph; Hatin et al. 2013), whether a right whale could swim out of any area with noise above the behavioral disturbance threshold threshold in less time than it would take to complete installation of a single pile is dependent on the animal's swim speed and where it started in relation to the pile. Given that the clearance procedures are designed to avoid pile driving if any right whales are able to be visually detected (or detected by PAM), it is likely that any right whales exposed to pile driving noise will be several kilometers from the source, which would limit the duration of exposure.

Based on best available information that indicates whales resume normal behavior quickly after the cessation of sound exposure (e.g., Goldbogen et al. 2013a; Melcon et al. 2012), we anticipate that exposed animals will be able to return to normal behavioral patterns (i.e., socializing, foraging, resting, migrating) after the exposure ends. If an animal exhibits an avoidance response, it would experience a cost in terms of the energy associated with traveling away from the acoustic source. That said, migration is not considered a particularly costly activity in terms of energetics (Villegas-Amtmann et al. 2015). The right whales exposed to pile driving noise above the behavioral disturbance threshold may experience one-time, temporary, disruptions to foraging activity; this would be the case if a right whale was foraging while pile driving started and it stopped foraging to move away from the noise or if it was actively avoiding the noisy area and did not forage during that period. However, given the opportunistic nature of foraging in the WDA during the time of year when pile driving will occur, we consider this to be a very low probability of occurrence. That is, pile driving will not occur at the times of year and location when sustained, multi-day foraging events are expected to occur in the WDA. As explained above, given that the duration of pile driving is short (4 to 12 hours a day), and we expect an individual to only be exposed to noise from a single pile driving event, we expect the potential for disruption of foraging to occur for a short period of time on a single day. Goldbogen et al. (2013a) hypothesized that if the temporary behavioral responses due to acoustic exposure interrupted feeding behavior, this could have impacts on individual fitness and eventually, population health. However, for this to be true, we would have to assume that an individual whale could not compensate for this lost feeding opportunity by either immediately feeding at another location once it escapes the noisy area, by feeding shortly after cessation of acoustic exposure, or by feeding at a later time. There is no indication this is the case, particularly since unconsumed prey would likely still be available in the environment following the cessation of acoustic exposure (i.e., the pile driving is not expected to disrupt copepod prey). There would likely be an energetic cost associated with any temporary displacement to find alternative locations for foraging, but unless disruptions occur over long durations or over subsequent days, which we do not expect, we do not anticipate this movement to be consequential to the animal over the long term (Southall et al. 2008). Disruption of resting and socializing may also result in short term stress. Efforts have been made to try to quantify the potential consequences of responses to behavioral disturbance, and frameworks have been developed for this assessment (e.g., Population Consequences of Disturbance). However, models that have been developed to date to address this question require many input parameters and, for most species, there are insufficient data for parameterization (Harris et al. 2017a). Nearly all studies and experts agree that infrequent exposures of a single day or less are unlikely to impact an individual's overall energy budget (Farmer et al. 2018; Harris et al. 2017b; King et al. 2015b; NAS 2017; New et al. 2014; Southall et al. 2008; Villegas-Amtmann et al. 2015). Based on best available information, we expect this to be the case for North Atlantic right whales exposed to acoustic stressors associated with this project even for animals that may already be in a stressed or compromised state due to factors unrelated to the SouthCoast project.

Based on best available information that indicates whales resume normal behavior quickly in their new location after the cessation of sound exposure (e.g., Goldbogen et al. 2013a; Melcon et al. 2012), we anticipate that the individuals exposed to noise above the behavioral disturbance threshold will resume normal behavioral patterns (primarily migrating, but also resting, socialization, and opportunistic foraging) after the exposure ends. If an animal exhibits an avoidance response, it would experience a cost in terms of the energy associated with traveling away from the acoustic source. That said, migration is not considered a particularly costly activity in terms of energetics (Villegas-Amtmann et al. 2015). An animal that was migrating through the area and was exposed to pile driving noise would make minor alterations to their route, taking them only a few kilometers out of their way. This is far less than the distance normally traveled over the course of a day (they have been tracked moving more than 80 km in a day in the Gulf of St. Lawrence) and we expect that even for stressed individuals or mother-calf pairs, this alteration in course would result in only a small energetic impact that would not have consequences for the animals health or fitness.

We have also considered the possibility that a resting animal could be exposed to pile driving noise and its rest disturbed. Resting would be disrupted until the animal moved outside of the area with increased pile driving noise. As explained above, we expect this disruption would likely last less than an hour (the time it would take to swim outside the area with noise above the behavioral disturbance threshold) but could last 4 to 12 hours. Given that disruptions to resting will be a one-time event that likely lasts only a few minutes and at most a few hours, we expect that any exposed individuals would be able to make up that lost rest without consequences to their overall energy budget, health, or fitness. This conclusion remains valid even considering an individual that was exposed to pile driving noise on a single day in multiple construction years as we would expect full recovery between exposures.

Stress responses are also anticipated in the right whales experiencing temporary behavioral disruption due to exposure to noise during foundation installation. However, the available literature suggests these acoustically induced stress responses will be of short duration (similar to the duration of exposure), and not result in a chronic increase in stress that could result in physiological consequences to the animal; this is true for all potentially exposed animals, including mother-calf pairs. The stress response is expected to fully resolve when the animal has moved away from the disturbing levels of noise; as such, the stress response is limited to the anticipated minutes to up to 12 hours that the individual right whales are expected to be exposed to disturbing levels of noise during impact pile driving. These short-term stress responses are not equivalent to stress responses and associated elevated stress hormone levels that have been observed in North Atlantic right whales that are chronically entangled in fishing gear (Rolland et al. 2017). This is also in contrast to stress level changes observed in North Atlantic right whales due to fluctuations in chronic ocean noise. Rolland et al. (2012) documented that stress hormones in North Atlantic right whales significantly decreased following the events of September 11, 2001 when shipping was significantly restricted. This was thought to be due to the resulting decline in ocean background noise level because of the decrease in shipping traffic. As noted in Southall et al. (2008), substantive behavioral reactions to noise exposure (such as disruption of critical life functions, displacement, or avoidance of important habitat) are considered more likely to be significant if they last more than 24 hours, or recur on subsequent days; this is not the case here as the behavioral response and associated effects will in all cases last no more than 12 hours and will not recur on subsequent days. Because we expect these individuals to only be exposed to a single pile driving event in any construction season, and that there would be complete recovery prior to exposure in a second construction season, we do not expect chronic exposure to pile driving noise. In summary, we do not anticipate long duration exposures to occur, and we do not anticipate that behavioral disturbance and associated stress response as a result of exposure to pile driving noise will affect the health of any individual and therefore, there would be no consequences on body condition or other factor that would affect health, survival, reproductive or calving success**.**

As noted above, TTS represents primarily tissue fatigue and is reversible (Southall et al., 2008). Temporary hearing loss is not considered physical injury but will cause auditory impairment to animals over the short period in which the TTS lasts. The TTS experienced by right whales exposed to pile driving noise is expected to be a minor degradation of hearing capabilities within regions of hearing that align most completely with the energy produced by pile driving (i.e. the low-frequency region below 2 kHz), not severe hearing impairment. If hearing impairment occurs, it is most likely that the affected animal would temporarily lose a few decibels in its hearing sensitivity, which, given the limited impact to hearing sensitivity, is not likely to meaningfully affect its ability to forage and communicate with conspecifics, including communication between mothers and calves. We anticipate that any instances of TTS will be of minimum severity and short duration. This conclusion is based on literature indicating that even following relatively prolonged periods of sound exposure resulting in TTS, recovery occurs quickly (Finneran 2015). TTS is expected to resolve within a day and in all cases would resolve within a week of exposure (that is, hearing sensitivity will return to normal) and is not expected to affect the health of any whale or its ability to migrate, forage, breed, or calve (Southall et al. 2008); more information on the effects of TTS is provided below.

Masking occurs when the receipt of a sound is interfered with by another coincident sound at similar frequencies and at similar or higher intensity. Pile driving noise may mask right whale calls and could have effects on mother-calf communication and behavior. If such effects were severe enough to prevent mothers and calves from reuniting or initiating nursing, they may result in missed feeding opportunities for calves, which could lead to reduced growth, starvation, and even death. Any mother-calf pairs in the action area would have left the southern calving grounds and be making northward migrations to northern foraging areas. The available data suggests that North Atlantic right whale mother-calf pairs rarely use vocal communication on the calving grounds and so the two maintain visual contact until calves are approximately three to four months of age (Parks and Clark 2007; Parks and Van Parijs 2015; Root-Gutteridge et al. 2018; Trygonis et al. 2013). Such findings are consistent with data on southern right and humpback whales, which appear to rely more on mechanical stimulation to initiate nursing rather than vocal communication (Thomas and Taber 1984; Videsen et al. 2017). When mother-calf pairs leave the calving grounds and begin to migrate to the northern feeding grounds, if they begin to rely on acoustic communication more, then any masking could interfere with mother-calf reunions. For example, even though humpback whales do not appear to use vocal communication for nursing, they do produce low-level vocalizations when moving that have been suggested to function as cohesive calls (Videsen et al. 2017). However, when calves leave the foraging grounds at around four months of age, they are expected to be more robust and less susceptible to a missed or delayed nursing opportunity. Any masking would only last for the duration of the exposure to pile driving noise, which in all cases would be no more than four hours for installation of a single pile, up to 12 hours considering installation of multiple piles in a day. As such, even if masking were to interfere with mother-calf communication in the action area, we do not anticipate that such effects would result in fitness or health consequences given their short-term nature. We also note that given the time of year restriction on impact pile driving and that mother-calf pairs are most likely to swim through the WDA in March and April

(LaBreque et al. 2015) and are less likely to be present when impact pile driving occurs between May and December.

Quantifying the fitness consequences of sub-lethal impacts from acoustic stressors is exceedingly difficult for marine mammals, and we do not currently have data to conduct a quantitative analysis on the likely consequences of such sub-lethal impacts. While we are unable to conduct a quantitative analysis on how sub-lethal behavioral effects and temporary hearing impacts (i.e., masking and TTS) may impact animal vital rates (and therefore fitness), based on the best available information, we expect an increased likelihood of consequential effects when exposures and associated effects are long-term and repeated, occur in locations where the animals are conducting critical activities, and when the animal affected is in a compromised state. While we acknowledge that some of the right whales exposed to pile driving noise may be in a compromised state, individual exposures will be short term (in most cases less than an hour but potentially for up to 12 hours) and given the intermittent use of the lease area in the areas and times when pile driving will occur, repeated exposures of a single individual in a single construction season are unlikely. The effects of this temporary exposure and associated behavioral response, inclusive of TTS, will not affect the health or fitness of any individual right whale.

Harris et al. (2017a) summarized the research efforts conducted to date that have attempted to understand the ways in which behavioral responses may result in long-term consequences to individuals and populations. Efforts have been made to try to quantify the potential consequences of such responses, and frameworks have been developed for this assessment (e.g., Population Consequences of Disturbance). However, models that have been developed to date to address this question require many input parameters and, for most species, there are insufficient data for parameterization (Harris et al. 2017a). Nearly all studies and experts agree that infrequent exposures of a single day or less are unlikely to impact an individual's overall energy budget (Farmer et al. 2018; Harris et al. 2017b; King et al. 2015b; NAS 2017; New et al. 2014; Southall et al. 2008; Villegas-Amtmann et al. 2015). Based on best available information, we expect this to be the case for North Atlantic right whales exposed to pile driving noise even for animals that may already be in a stressed or compromised state due to factors unrelated to the SouthCoast project. We do not anticipate that instances of behavioral response and any associated energy expenditure or stress will impact an individual's overall energy budget or result in any health or fitness consequences to any individual North Atlantic right whales.

We have also considered whether TTS, masking, or avoidance behaviors would be likely to increase the risk of vessel strike or entanglement in fishing gear. As explained above, we would not expect the TTS to span the entire communication or hearing range of right whales given the frequencies produced by pile driving do not span entire hearing ranges for right whales. Additionally, though the frequency range of TTS that right whales might sustain would overlap with some of the frequency ranges of their vocalization types, the frequency range of TTS from SouthCoast's pile driving activities would not span the entire frequency range of one vocalization type, much less span all types of vocalizations or other critical auditory cues. Masking may also make it more difficult for the individual to hear other animals or to detect auditory cues; however, masking resolves as soon as the animal moves sufficiently far from the source. As such, while TTS and masking may temporarily affect the ability of a right whale to communicate with other right whales or to detect audio cues to the extent they rely on audio cues to avoid vessels or other threats, we do not expect these effects to be so severe that they would prevent the affected individual from communicating or limit their response to acoustic cues such that it would prevent them from responding to a threat. For example, to the extent that a right whale relies on acoustic cues to detect and move away from nearby vessels, which is largely unknown, TTS and/or masking could slow the animal's response time. However, these risks are lowered by the limited nature of the TTS, the short duration of TTS (likely minutes to hours and in all cases less than a week) and masking (limited only to the time that the whale is exposed to the pile driving noise, so from a few minutes up to approximately 12 hours). As such, while TTS and masking may increase the likelihood of injury by temporarily affecting the ability of an individual to use acoustic cues to respond to threats or stressors, the effects are not expected to be so severe to actually increase the risk that a right whale will be injured. That is, while TTS and masking may temporarily effect the behavior of a right whale in a way that affects its ability to use acoustic cues to detect and respond to threats, we do not expect this response will be so impacted that it would actually result in a whale being hit by a vessel or becoming entangled in fishing gear or otherwise resulting in injury or mortality.

While we do expect pile driving noise to cause avoidance and temporary localized displacement as discussed above, we do not expect that avoidance of pile driving noise would result in right whales moving to areas with higher risk of vessel strike or entanglement in fishing gear. Information on patterns and distribution of vessel traffic and fishing activity, including fishing gear that may result in the entanglement or capture of sea turtles, is illustrated in the Navigational Safety Risk Assessment prepared for the SouthCoast Project (COP Appendix X). Based on the available information, we do not expect avoidance of pile driving noise to result in an increased risk of vessel strike or entanglement in fishing gear. This determination is based on the relatively small size of the area with noise that a right whale is expected to avoid during impact pile driving (up to 9 km from the pile being installed), the short term nature of any disturbance, and the lack of any significant differences in vessel traffic or fishing activity in that 9 km area that would put a right whale at greater risk of vessel strike or entanglement/capture. We recognize that the distance (acoustic range) to the behavioral disturbance threshold during vibratory pile setting is significantly larger; however, the short duration of that noise (20-90 minutes per pile), limits the distance that a right whale would be expected to travel to avoid the noise to less than about 4 km (the distance we would expect a right whale to travel in that period of time).

The ESA's definition of take includes harassment of a listed species. NMFS Interim Guidance on the ESA Term "Harass" (PD 02-110-19); December 21, 2016[42] provides for a four-step process to determine if a response meets the definition of harassment. The Interim Guidance defines harassment as to "[c]reate the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering." The guidance states that NMFS will consider the following steps in an assessment of whether proposed activities are likely to harass: 1) Whether an animal is likely to be exposed to a stressor or disturbance (i.e., an annoyance); and 2) The nature of that exposure in terms of magnitude, frequency, duration, etc. Included in this may be type and scale

[42] Available at: https://www.fisheries.noaa.gov/national/laws-and-policies/protected-resources-policy-directives

as well as considerations of the geographic area of exposure (e.g., is the annoyance within a biologically important location for the species, such as a foraging area, spawning/breeding area, or nursery area?); 3) The expected response of the exposed animal to a stressor or disturbance (e.g., startle, flight, alteration [including abandonment] of important behaviors); and 4) Whether the nature and duration or intensity of that response is a significant disruption of those behavior patterns which include, but are not limited to, breeding, feeding, or sheltering, resting or migrating.

Here, we carry out that four-step assessment to determine if the effects to the 109 individuals expected to be exposed to noise above the behavioral disturbance threshold meet the definition of harassment. We have established that up to 109 individual right whales will be exposed to levels of noise above the threshold at which we expect TTS and behavioral response to occur, we also expect exposure to noise will result in masking (step 1). For an individual, the nature of this exposure is expected to be limited to a one-time exposure to pile driving noise and will last for as long as it takes the individual to swim away from the disturbing noise or, at maximum, the duration of the pile driving in a single day (up to 12 hours) with TTS lasting for as long as a week; this disruption will occur in areas where individuals may be migrating, foraging, resting, or socializing (step 2). Animals that are exposed to this noise are expected to abandon their activity and move far enough away from the pile being driven to be outside the area where noise is above the behavioral disturbance threshold. As explained above, these individuals are expected to experience TTS (temporary hearing impairment due to loss of hearing sensitivity), masking, stress, disruptions to behaviors including foraging, resting, socializing, and migrating, and energetic consequences of moving away from the pile driving noise and potentially needing to seek out alternative patches of copepod prey (step 3). As explained above, breeding and calving do not occur in the action area or do not occur at the time of year when exposure to pile driving could occur. Together, these effects will significantly disrupt a right whale’s normal behavior for the period that the exposure occurs, additionally TTS is expected to affect the animal’s behavior, including limited impacts on its ability to communicate and use acoustic cues to detect and respond to threats for the period before TTS resolves (up to a week); that is, the nature and duration/intensity of these responses are a significant disruption of normal behavioral patterns (considering the totality of behaviors that occur in the lease area at this time of year: migrating, resting, limited feeding) that creates the likelihood of injury (step 4). Therefore, based on this four-step analysis, we find that the 109 right whales exposed to pile driving noise above the behavioral disturbance threshold but below the onset of auditory injury threshold are likely to be adversely affected and that effect amounts to harassment. As such, we expect the harassment of up to 109 right whales as a result of pile driving for SouthCoast Project 1 and Project 2 foundation installation.

In summary, for all right whales exposed to pile driving noise above the behavioral disturbance threshold (total of 109), these effects will meet NMFS interim definition of harassment but not harm. In this case, the likelihood of injury is created by the combination of aversion/avoidance behavior, change in hearing sensitivity (TTS), masking, disruptions to resting, migrating, and feeding, increased stress and energetic consequences, and impacts on ability to detect and avoid threats that, together, are a significant disruption of normal behaviors. This disruption will persist for the duration of TTS and is not expected to last longer than 1 week or to be repeated in a single year (but may be repeated in subsequent construction years). These consequences will be greatest for individuals that are already compromised due to existing injuries or entanglements and reproductive females, which as described above, are expected to have depleted energy budgets and energy reserves.

NMFS defines "harm" in the ESA's definition of "take" as "an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding or sheltering" (50 CFR §222.102). No right whales will be injured or killed due to exposure to pile driving noise. Further, while exposure to pile driving noise will significantly disrupt normal behaviors of individual right whales on the day that the whale is exposed to the pile driving noise as well as for the period before TTS resolves (i.e., when hearing sensitivity returns to normal) creating the likelihood of injury, it will not actually kill or injure any right whales by significantly impairing any essential behavioral patterns. This is because behavioral disturbance, displacement, potential loss of foraging opportunities, and expending additional injury, will be limited to that short period of time and are expected to be fully recoverable, there will not be an effect on the animal's overall energy budget in a way that would compromise its ability to successfully obtain enough food to maintain its health, or impact the ability of any individual to make seasonal migrations or participate successfully in nursing, breeding, or calving. Further, we expect that any increased risk of injury created by a reduced ability to detect or respond to threats will not result in any actual injury or mortality (i.e., we do not expect any vessel strike, entanglement, predator interactions, etc. to actually occur). TTS will resolve within no more than a week of exposure and is not expected to affect the health of any whale or its ability to migrate, forage, breed, calve, or raise its young. We also expect that stress responses will resolve with TTS and there will not be such an increase in stress that there would be physiological consequences to the individual that could affect its health or ability to socialize, migrate, forage, breed, calve, or raise its young. Thus, as no injury or mortality will actually occur, the response of right whales to pile driving noise does not meet the definition of "harm."

Blue, Fin, Sei, and Sperm Whales

Behavioral responses may impact health through a variety of different mechanisms, but most Population Consequences of Disturbance (PCoD) models focus on how such responses affect an animal's energy budget (Costa et al. 2016c; Farmer et al. 2018; King et al. 2015b; NAS 2017; New et al. 2014; Villegas-Amtmann et al. 2017). Responses that relate to foraging behavior, such as those that may indicate reduced foraging efficiency (Miller et al. 2009) or involve the complete cessation of foraging, may result in an energetic loss to animals. Other behavioral responses, such as avoidance, may have energetic costs associated with traveling (NAS 2017). When considering whether energetic losses due to reduced foraging or increased traveling will affect an individual's fitness, it is important to consider the duration of exposure and associated response. Nearly all studies and experts agree that infrequent exposures of a single day or less are unlikely to impact an individual's overall energy budget and that long duration and repetitive disruptions would be necessary to result in consequential impacts on an animal (Farmer et al. 2018; Harris et al. 2017b; King et al. 2015b; NAS 2017; New et al. 2014; Southall et al. 2008; Villegas-Amtmann et al. 2015). As explained below, individuals exposed to pile driving noise will experience only a singular, temporary behavioral disruption that will not last for more than a few hours and are not expected to be repeated. As such, the factors necessary for behavioral disruption to have consequential impacts on an animal are not present in this case. We also recognize that aside from affecting health via an energetic cost, a behavioral response could result in more indirect impacts to health and/or fitness. For example, if a whale hears the pile driving noise and avoids the area, this may cause it to travel to an area with other threats such as vessel traffic or fishing gear. However, as explained below, this is extremely unlikely to occur.

Quantifying the fitness consequences of sub-lethal impacts from acoustic stressors is exceedingly difficult for marine mammals and we do not currently have data to conduct a quantitative analysis on the likely consequences of such sub-lethal impacts. While we are unable to conduct a quantitative analysis on how sub-lethal behavioral effects and temporary hearing impacts (i.e., masking) may impact animal vital rates (and therefore fitness), based on the best available information, we expect an increased likelihood of consequential effects when exposures and associated effects are long-term and repeated, occur in locations where the animals are conducting normal or essential behavioral activities, and when the animal affected is in a compromised state.

We do not have information to suggest that affected blue, sperm, sei, or fin whales are likely to be in a compromised state at the time of exposure. During exposure, affected animals may be engaged in migration, foraging, or resting. If blue, fin, sei, or sperm whales exhibited a behavioral response to pile driving noise, these activities would be disrupted, and the disruption may pose some energetic cost. However, as noted previously, responses to pile driving noise are anticipated to be singular and short term (up to 12 hours in a single day); that is, the identified number of individuals are each expected to be exposed to a single pile driving event that will result in the individual altering their behavior to avoid the disturbing level of noise. Based on the estimated abundance of blue, fin, sei, and sperm whales in the action area, anticipated residency time in the lease area, and the number of instances of behavioral disruption expected, multiple exposures of the same animal in a single construction season are not anticipated. Sperm whale's normal cruise speed is 5-15 kph, with burst speed of up to 35-45 kph for up to an hour. Fin whales cruise at approximately 10 kph while feeding and have a maximum swim speed of up to 35 kph. Sei whales swim at speeds of up to 55 kph. Blue whales transit around 5 kph, with burst speeds of at least 20 kph. During impact pile driving, the distance to the behavioral disturbance threshold (acoustic range; Table 17 in the Proposed Rule) extends up to 8.7 km for monopiles and up to 5.3 km for pin piles; given the expected duration of impact pile driving this noise would persist in the area for approximately 4 hours for a monopile and approximately 2.2 hours for a single pin pile (approximately 9 hours considering 4 pin piles installed in a day). During vibratory pile setting, the distance to the behavioral disturbance threshold is much larger (extending up to 84.7 km for monopiles and 22 km for pin piles); however, vibratory pile setting is only expected for about 20 minutes per monopile and 90 minutes per pin pile (followed by impact pile driving). Considering these distances and whale swim speed, whether an individual whale could swim out of any area with noise above the behavioral disturbance threshold in less time than it would take to complete installation of a single pile is dependent on the animal's swim speed and where it started in relation to the pile. Given the size of the clearance zones, it is likely that any whales exposed to pile driving noise will be several kilometers from the source, which would limit the duration of exposure. In any event, it would not exceed the period of a pile driving event.

Considering the density and distribution of blue, fin, sei, and sperm whales in the WDA and their known prey, disruptions of foraging activity are most likely for individual fin whales. Goldbogen et al. (2013a) suggested that if the documented temporary behavioral responses interrupted feeding behavior, this could have impacts on individual fitness and eventually, population health. However, for this to be true, we would have to assume that an individual whale could not compensate for this lost feeding opportunity by either immediately feeding at another location, by feeding shortly after cessation of acoustic exposure, or by feeding at a later time. There is no indication this will occur, particularly since unconsumed prey would still be available in the environment following the cessation of acoustic exposure (i.e., the pile driving is not expected to result in a reduction in prey). There would likely be an energetic cost associated with any temporary habitat displacement to find alternative locations for foraging, but unless disruptions occur over long durations or over subsequent days, we do not anticipate this movement to be consequential to the animal over the long-term (Southall et al 2008). Based on the estimated abundance of fin, sei, and sperm whales in the action area, anticipated residency time in the lease area, and the number of instances of behavioral disruption expected, multiple exposures of the same animal are not anticipated. Therefore, we anticipate that repeat exposures in a single construction season are unlikely, and based on the available literature that indicates infrequent exposures are unlikely to impact an individual's overall energy budget (Farmer et al. 2018; Harris et al. 2017b; King et al. 2015b; NAS 2017; New et al. 2014; Southall et al. 2008; Villegas-Amtmann et al. 2015), we do not expect this level of exposure to impact the fitness of exposed animals. Given that we expect complete recovery from TTS within no more than a week, we do not expect that an animal that is exposed to pile driving noise in subsequent construction seasons would experience any additive or different effects.

There is no indication that sperm whale calves occur in the action area. For blue, fin, and sei whales, little information exists on where they give birth as well as on mother-calf vocalizations. As such, it is difficult to assess whether masking could significantly interfere with mother-calf communication in a way that could result in fitness consequences. In our judgment it is reasonable to assume here that it is likely that some of the blue, sei or fin whales exposed to pile driving noise are mother-calf pairs. Absent data on mother-calf communication for these species within the action area, we rely on our analysis of the effects of masking to North Atlantic right whales, which given their current status, are considered more vulnerable than any of these whale species. Based on this analysis, we expect that any effects of TTS and/or masking on communication or nursing by blue, fin, or sei whale mother-calf pairs will be extremely unlikely to occur or will be so small that they cannot be meaningfully measured, evaluated, or detected; therefore, all effects of TTS and/or masking on mother-calf fitness will be insignificant or discountable.

We have also considered whether TTS, masking, or avoidance behaviors would be likely to increase the risk of vessel strike or entanglement in fishing gear. As explained above, we would not expect the TTS to span the entire communication or hearing range of blue, fin, sei, or sperm whales given the frequencies produced by pile driving do not span entire hearing ranges for any whales. Additionally, though the frequency range of TTS that blue, fin, sei, or sperm whales might sustain would overlap with some of the frequency ranges of their vocalization types, the frequency range of TTS from SouthCoast's pile driving activities would not span the entire frequency range of one vocalization type, much less span all types of vocalizations or other critical auditory cues for any given species. As such, we do not expect TTS to affect the ability of any of these whales to communicate with other whales or to detect audio cues to the extent they rely on audio cues to avoid vessels or other threats. Similarly, we do not expect masking to affect the ability of a whale to avoid a vessel. Masking may also make it more difficult for the individual to hear other animals or to detect auditory cues; however, masking resolves as soon as the animal moves sufficiently far from the source. As such, while TTS and masking may temporarily affect the ability of a whale to communicate with other whales or to detect audio cues to the extent they rely on audio cues to avoid vessels or other threats, we do not expect these effects to be so severe that they would prevent the affected individual from communicating or limit their response to acoustic cues such that it would prevent them from responding to a threat. For example, to the extent that an individual whale relies on acoustic cues to detect and move away from nearby vessels, which is largely unknown, TTS and/or masking could slow the animal's response time. However, these risks are lowered even further by the short duration of TTS (likely minutes to hours but less than a week) and masking (limited only to the time that the whale is exposed to the pile driving noise, so less than the 12 hours that pile driving occurs in a single day). As such, while TTS and masking may increase the likelihood of injury by temporarily affecting the ability of an individual to use acoustic cues to respond to threats or stressors, the effects are not expected to be so severe to actually increase the risk that a sperm, fin, sei or blue whale will not be able to avoid detection of a threat that would result in injury or mortality.

While we do expect pile driving noise to cause avoidance and temporary localized displacement as discussed above, we do not expect that avoidance of pile driving noise would result in any blue, fin, sei, or sperm whales moving to areas with higher risk of vessel strike or entanglement in fishing gear. Information on patterns and distribution of vessel traffic and fishing activity, including fishing gear types that present a risk of entanglement, is illustrated in the Navigational Safety Risk Assessment prepared for the SouthCoast Project (COP Appendix X). Based on the available information, we do not expect avoidance of pile driving noise resulting in an increased risk of vessel strike or entanglement in fishing gear. This determination is based on the relatively small size of the area with noise that a whale is expected to avoid (no more than 9 km from the pile being installed), the short term nature of any disturbance, and the lack of any significant differences in vessel traffic or fishing activity in that 9km area that would put an individual whale at greater risk of vessel strike or entanglement/capture.

We set forth the NMFS interim guidance definition of ESA take by harassment above and the four-step analysis to evaluate whether harassment is reasonably certain to occur. Here, we carry out that four-step assessment to determine if the effects to the 2 blue, 520 fin, 47 sei, and 135 sperm whales expected to be exposed to noise above the behavioral disturbance threshold meet the definition of harassment. We have established that up to 2 blue, 520 fin, 47 sei, and 135 sperm whales will be exposed to levels of noise above the threshold at which we expect TTS and behavioral response to occur; we also expect exposure to noise will result in masking (step 1). For an individual, the nature of this exposure is expected to be limited to a one-time exposure to pile driving noise and will last for as long as it takes the individual to swim away from the disturbing noise or, at maximum, the duration of the pile event (up to 12 hours in a day), with TTS lasting for as long as a week; this disruption will occur in areas where individuals may be migrating, foraging, resting, or socializing (step 2). Animals that are exposed to this noise are expected to abandon their activity and move far enough away from the pile being driven to be outside the area where noise is above the behavioral disturbance threshold. As explained above, these individuals are expected to experience TTS (temporary hearing impairment due to a temporary reduction in hearing sensitivity), masking, stress, disruptions to behaviors including foraging, resting, socializing, and migrating, and energetic consequences of moving away from the pile driving noise and potentially needing to seek out alternative locations to forage (step 3). As explained above, breeding and calving do not occur in the action area or do not occur at the time of year when exposure to pile driving could occur. Together, these effects will significantly disrupt an individual blue, fin, sei, or sperm whale's normal behavior for that period that the exposure occurs. Additionally TTS is expected to affect the animal's behavior, including limited impacts on its ability to communicate and use acoustic cues to detect and respond to threats for the period before TTS resolves (up to a week); that is, the nature and duration/intensity of these responses are a significant disruption of normal behavioral patterns that creates the likelihood of injury (step 4). Therefore, based on this four-step analysis, we find that the 2 blue, 520 fin, 47 sei, and 135 sperm whales exposed to pile driving noise louder than 160 dB re 1uPa rms threshold are likely to be adversely affected and that effect amounts to harassment. As such, we expect the harassment of up to 2 blue, 520 fin, 47 sei, and 135 sperm whales as a result of exposure to pile driving noise above the behavioral disturbance threshold but below the onset of auditory injury threshold.

In summary, for the blue, fin, sei, and sperm whales exposed to pile driving noise above the behavioral disturbance threshold, these effects will meet NMFS interim definition of harassment but not harm. In this case, the likelihood of injury is created by the combination of aversion/avoidance behavior, change in hearing sensitivity (TTS), masking, disruptions to resting, migrating, and feeding, increased stress and energetic consequences, and impacts on ability to detect and avoid threats that, together, are a significant disruption of normal behaviors. This disruption will persist for the duration of TTS and is not expected to last longer than 1 week or to be repeated in a single year (but may be repeated in subsequent construction years). These consequences will be greatest for any individuals that are already compromised due to existing injuries or entanglements and reproductive females.

As noted, NMFS defines "harm" for ESA take purposes as "an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding or sheltering." No blue, fin, sei, or sperm whales will be injured or killed due to exposure to pile driving noise above the behavioral disturbance threshold but below the onset of auditory injury threshold. Further, while exposure to pile driving noise will significantly disrupt normal behaviors of individual whales on the day that the whale is exposed to the pile driving noise as well as for the period before TTS resolves (i.e., when hearing sensitivity returns to normal) creating the likelihood of injury, it will not actually kill or injure any individuals by significantly impairing any essential behavioral patterns. This is because behavioral disturbance, displacement, potential loss of foraging opportunities, and expending additional injury, will be limited to that short period of time and are expected to be fully recoverable, there will not be an effect on the animal's overall energy budget in a way that would compromise its ability to successfully obtain enough food to maintain its health, or impact the ability of any individual to make seasonal migrations or participate successfully in nursing, breeding, or calving. Further, we expect that any increased risk of injury created by a reduced ability to detect or respond to threats will not result in any actual injury or mortality (i.e., we do not expect any vessel strike, entanglement, predator interactions, etc. to actually occur). TTS will resolve within no more than a week of exposure and is not expected to affect the health of any whale or its ability to migrate, forage, breed, calve, or raise its young. We also expect that stress responses will resolve with TTS and there will not be such an increase in stress that there would be physiological consequences to the individual that could affect its health or ability to socialize, migrate, forage, breed, calve, or raise its young. Thus, as no injury or mortality will actually occur, the response of right whales to pile driving noise does not meet the definition of "harm."

7.1.3.3 Effects of Exposure to UXO Detonations

The proposed action as described by BOEM in the BA includes the detonation of up to 10 UXOs. NMFS OPR has also considered the detonation of up to 10 UXOs in the MMPA proposed rule. As described above, modeling was carried out to support the assessment of effects of UXO detonation. UXO detonation may occur along the cable corridor and within the WFA (i.e., the lease area); modeling was carried out at five locations (lease area and cable route and a range of depths from 10 to 60m) (see Figure 1 in Hannay and Zykov 2022). Because SouthCoast will be required (through conditions of COP approval and conditions of the proposed MMPA ITR) to implement noise attenuation of at least 10 dB for all UXO detonations, effects to marine mammals from attenuated detonations are considered here.

Consistent with the requirements of the proposed ITR, the size of the pre-detonation clearance zones are set based on charge size; however, if charge size is not known or can not be definitively identified prior to the detonation, the clearance zone for the largest charge (1,000 kg) will be required. Clearance zones along with the distance to the onset of auditory injury (PTS) and Level B harassment (TTS) thresholds included in the Proposed Rule and November 1, 2024 update memo are presented in the table below. Note that during the consultation period, NMFS OPR clarified that consistent with the text in the Proposed Rule, the clearance zone size for North Atlantic right whale is "any distance." Detonation must not occur if a North Atlantic right whale is visually or acoustically detected at any distance from the detonation site. An area extending 10 km from the detonation site will be monitored with PAM. Any large whale that can not be confirmed to not be a right whale will be treated as a right whale for purposes of clearance/delay of detonations.

Table 7.1.23 –Clearance Zones (in Meters (m)) During UXO/MEC Detonations in the Export Cable Corridor (ECC) and Lease Area (LA), by Charge Weight and Assuming 10 dB of Sound Attenuation

UXO/MEC Charge Weights	Low-frequency cetaceans (blue, fin, right, sei whales)		Mid-frequency cetaceans (sperm whales)	
	ECC	LA	ECC	LA

PAM Clearance Zone[1]		15,000 m			
E4 (2.3 kg)	Clearance Zone (m)	800	400	100	50
E6 (9.1 kg)	Clearance Zone (m)	1,500	900	200	50
E8 (45.5 kg)	Clearance Zone (m)	2,900	1,900	300	100
E10 (227 kg)	Clearance Zone (m)	4,200	3,500	500	300
E12 (454 kg)	Clearance Zone (m)	4,900	4,500	700	400

1 – The PAM system used during clearance must be designed to detect marine mammal vocalizations, maximize baleen whale detections, and must be capable of detecting North Atlantic right whales at 15 km (9.3 mi).
The clearance zone sizes are contingent on being able to demonstrate that they can identify charge weights in the field; if they cannot identify the charge weight sizes in the field then they would need to assume the E12 charge weight size for all detonations and must implement the E12 clearance zone. The entire clearance zone must be able to be monitored by the visual PSOs
source: Table 55 in 89 FR 53708, and November 1, 2024 Updates

A complete description of the modeling is included in the proposed MMPA ITA and summarized in the Proposed Rule; updated modeling was completed by SouthCoast in October 2024 (Frankel et al. 2024) and transmitted to us with the November 1 memo from NMFS OPR. Results are summarized here. Charge weights of 2.3 kgs, 9.1 kgs, 45.5 kgs, 227 kgs, and 454 kgs, were modeled at five different locations to determine acoustic ranges to mortality, gastrointestinal injury, lung injury, PTS, and TTS thresholds. All marine mammal exposures were modeled using frequency-weighted sound exposure levels (SEL). The maximum distances to the thresholds for mortality, lung injury, and gastro-intestinal injury are shown in Table 7.1.24.

Table 7.1.24 Maximum Distances to Non-Auditory Injury and Mortality Thresholds for Marine Mammals (10 dB mitigation) considering all modeled sites and largest charge sizes.

Threshold Type	Marine Mammal Species	Maximum Distance (m) to Thresholds	
		Adult	Calf
Mortality	Baleen whale/sperm whale	34	109
Lung Injury	Baleen whale/sperm whale	80	237
Onset Gastrointestinal Injury (all species)[a]		125	125

Source: Hannay and Zykov 2022.
Notes: Maximum ranges are based on worst-case scenario modeling results for charge size E12 (454 kilograms)
[a] Based on 1% of animals exposed (mortality/Lung injury).
m = meters; UXO = unexploded ordnance

NMFS OPR determined that given the impact zone sizes (less than 250 m) and the required mitigation and monitoring measures, neither mortality nor non-auditory injury are considered likely to result from the activity; as such, NMFS OPR is not proposing to authorize any non-auditory injury, serious injury, or mortality of marine mammals from UXO/MEC detonation in the MMPA ITA. Given the requirements to clear an area larger than the distance to the non-auditory injury, serious injury, or mortality thresholds and the use of multiple PSO platforms and PAM, it is extremely unlikely that a detonation would occur with a whale within 250 m of the UXO/MEC to be detonated. As such, we agree with OPR's assessment and conclude that exposure of any ESA listed whale to noise that could result in mortality, serious injury, or non-auditory injury is extremely unlikely to occur.

To estimate the maximum ensonified zones where an animal could be exposed to PTS or TTS from UXO/MEC detonations, the largest acoustic range ($R_{95\%}$; assuming 10dB attenuation) to PTS and TTS thresholds of an E12 UXO/MEC charge weight were used as radii to calculate the area of a circle (pi × r^2; where r is the range to the threshold level) for each marine mammal hearing group (Hannay and Zykov 2022, Frankel et al. 2024). The results represent the largest area potentially ensonified above threshold levels from a single detonation (Tables 7.1.25 and 7.1.26).

Table 7.1.25. Largest SEL-based $R_{95\%}$ PTS-onset Ranges for the E12 Charge Weight (454 kg) with 10 dB Attenuation for ECC (S1 and S2) and Lease Area (S3, S4, S5).

Marine Mammal Hearing Group	Threshold (dB *re 1 $\mu Pa^2 s$*)	Distance (m) to PTS threshold (R95%)	
		ECC	Lease Area
Low-frequency cetaceans	183	4,410	4,680
Sperm whales	193	256	609

source: Tables 15- 19 in Frankel et al. 2024

Table 7.1.26. SEL-based $R_{95\%}$ TTS-onset Ranges for the E12 Charge Weight (454 kg) with 10 dB Reduction.

Marine Mammal Hearing Group	Threshold (dB *re 1 $\mu Pa^2 s$*)	Distance (m) to TTS threshold (R95%)	
		ECC	Lease Area

Low-frequency cetaceans	168	20,900	14,700
Sperm whale	178	3,290	3,980

source: Tables 20-24 in Frankle et al. 2024

As described in the Proposed Rule, to estimate the amount of MMPA take that may occur incidental to UXO/MEC detonation, given that UXOs have the potential to occur anywhere within the WDA, SouthCoast calculated monthly densities for each species within an identified perimeter around both the lease area and the export cable route for purposes of obtaining density information to inform the model. Highest monthly densities (from May – November for Project 1, and June through November for Project 2, the period when detonations could occur) for the area were used (see Tables 42 and 43 in LGL 2024). Density data was derived from Roberts et al. 2022. For the exposure modeling, the highest density month (year-round) was used. For blue whales, annual density was used. The densities used are presented in Table 7.1.27.

Table 7.1.27. Highest Monthly Marine Mammal Densities (Animals per Km^2) Used for the Modeling of SouthCoast's UXO/MEC detonations

Marine Mammal Species	Highest Density Month	Estimated Density	
		ECC	Lease Area
Blue whale	Annual Density	0.0000	0.0000
Fin whale	May- ECC; July – Lease Area	0.0013	0.0047
North Atlantic right whale	May	0.0022	0.0037
Sei whale	May	0.0007	0.0019
Sperm whale	August	0.0003	0.0017

Source: Table 43 in 89 FR 53708, Tables 42 and 43 in LGL 2024

The estimated maximum PTS and TTS exposures, assuming all 10 detonations are for a 1,000-kg charge (the largest anticipated), with 5 along the ECC and 5 in the lease area, are presented in Table 54 in LGL 2024 (Table 7.1.28 below).

Table 7.1.28. Estimated Level A and B Harassment Exposures of Marine Mammals Resulting from the Possible Detonation of up to 10 UXOs with 10 dB of Sound Attenuation, Considering Density Based Exposure Estimates

Species	Level A Harassment (PTS SEL)		Level B Harassment (TTS SEL)	
	Year 1	Year 2	Year 1	Year 2
Blue whale	0.004	0.002	0.07	0.046
Fin whale	1.1	0.7	28.9	19.3
North Atlantic right whale	1.1	0.3	22.9	4.4
Sei whale	0.5	0.2	11.9	3.6
Sperm whale	0.002	0.002	0.4	0.3

Source: Table 54 in LGL 2024

As explained in the MMPA Proposed Rule, as there is no more than one detonation per day, the TTS threshold is expected to represent the level above which any behavioral disturbance might occur. As such, the number of individuals estimated to be exposed to noise above the Level B harassment threshold accounts for those that would experience TTS or behavioral disturbance. We note that given the short duration of a detonation (less than one second), the potential for behavioral disturbance to last more than a very short period is extremely limited. Although UXO/MEC exposure modeling estimated potential auditory injury (PTS) exposures for fin (1.8), right (1.4), and sei (0.7) whales, SouthCoast did not request authorization for Level A harassment for these species given their determination that their proposed monitoring and mitigation measures would prevent this form of take incidental to UXO/MEC detonations. As described in the proposed rule, OPR concurred with this determination and is not proposing to authorize any Level A take of any ESA listed whales as a result of exposure to UXO/MEC detonations. As explained further below and as illustrated in Table 7.1.21, NMFS OPR is proposing to authorize Level B harassment of 2 blue, 22 fin, 17 right, 10 sei, and 4 sperm whales as a result of exposure to detonation of up to 10 UXOs.

Table 7.1.29. Level B Take Proposed for Authorization - Resulting From the Detonation Of Up To 10 UXOs, with 10 dB of Sound Attenuation.

Species	Level B Harassment (TTS)
Blue whale	2
Fin whale	49
North Atlantic right whale	28
Sei whale	16

Sperm whale	4

source: November 1 2024 update memo

For sperm whales, the distance to the PTS threshold ranges up to approximately 600 m from the detonation; that is, considering even the largest charge size, a sperm whale would need to be within that distance of the detonation to experience PTS. The distance to non-auditory injury (i.e., gastric or lung injury) is even smaller (no greater than 237 m) and the distance to the mortality threshold is even smaller still (125 m). The clearance zone for sperm whales is larger than the distance to the PTS threshold for all detonation sizes (e.g., for the largest charge size, the clearance zone is 700 m) and is larger than the associated distance to the PTS or other injury or mortality threshold. Given that PSOs will be monitoring the area from at least two platforms, we expect that the clearance zone will be effective at reducing the risk of exposure of a sperm whale to noise such that PTS is extremely unlikely to occur. Similarly, we expect that the clearance zone will reduce the risk of exposure to noise that could result in mortality or lung or gastric injury such that it is extremely unlikely to occur. With these mitigation measures in place, SouthCoast and NMFS OPR determined that there was no potential for exposure of any ESA listed whales to noise that could result in mortality, or non-auditory injury. As such, SouthCoast did not request and NMFS OPR is not proposing to authorize any such take of sperm whales. This is consistent with the determination made in the BA by BOEM.

For right, fin, blue, and sei whales, the distance to the PTS threshold ranges up to 4,680 m dependent on charge size (see Table 7.1.25). The distance to non-auditory injury (i.e., gastric or lung injury) is much smaller (no greater than 237 m) and the distance to the mortality threshold is even smaller still (109 m) (Table 7.1.24). The clearance zone for right whales is "any distance" meaning that any detection of a right whale by a PSO at any distance from the PSO platform or any detection of a vocalizing right whale at any distance from the detonation site would delay detonation (noting that a distance out to 15 km will be monitored by PAM). For blue, fin, and sei whales the clearance zone is larger than the distance to the PTS threshold for all charge sizes. Only when marine mammals have been confirmed to have voluntarily left the clearance zones and been visually confirmed to be beyond the clearance zone, or when 60 minutes have elapsed without any redetections for whales may detonation commence. It is reasonable to expect that visual observers will be able to monitor the full extent of the clearance zone given the requirement for multiple observer platforms to monitor all but the smallest charge size. It is also important to note that given the extremely short duration of the noise associated with the detonation (one second) there is no risk of sustained or cumulative noise exposure.

Given that PSOs will be monitoring the area from at least two platforms and that this will be supplemented by PAM, we expect that the clearance zone will be effective at reducing the risk of exposure of a right, fin, sei, or blue whale to noise above the onset of auditory injury threshold such that PTS is extremely unlikely to occur. Similarly, we expect that the clearance zone will reduce the risk of exposure to noise that could result in mortality, or lung or gastric injury such that it is extremely unlikely to occur. With these mitigation measures in place, SouthCoast and NMFS OPR determined that there was no potential for exposure of any ESA listed whales to noise that could result in mortality, or non-auditory injury. As such, SouthCoast did not request and NMFS OPR is not proposing to authorize any such take of any ESA listed whales due to exposure to UXO detonations. This is consistent with the determination made in the BA by BOEM. As explained above, based on our independent evaluation of modeling, which represents the best available scientific information on the distances to noise thresholds, and our consideration of the extensive minimization measures, as well as considering the limited number of detonations (10 over a two year period), we conclude that exposure of any blue, fin, sei, or right whales to noise at or above the PTS threshold during any UXO detonation for the SouthCoast project is extremely unlikely to occur.

As explained in the MMPA proposed rule, to determine the amount of Level B harassment take proposed for authorization, OPR considered the density based exposure estimates for blue, right, sei, fin, and sperm whales (rounding each year's exposure up to whole numbers and adding the two years to get a total). Given the very low density estimates for blue whales, exposure was estimated based on group size (1) and the potential for exposure of one group annually. As explained in MMPA Proposed Rule, exposure to noise above the Level B harassment (but below the PTS threshold) for detonations is expected to result in TTS, with behavioral response limited to brief startle reactions (due to the short duration of the detonation). We have determined that effects to individuals from this extremely short behavioral disturbance will be so small that they cannot be meaningfully measured, evaluated, or detected and are therefore insignificant. Whales exposed to noise above the identified threshold may experience minor TTS (limited due to the very limited exposure period). As explained in the consideration of exposure to pile driving noise, TTS affects an individual through temporary hearing impairment which can affect the behavior of the individual by making it more difficult to hear certain sounds; however, while this minor TTS may affect the way an individual senses its environment we do not expect this minor TTS to affect communication between individuals or affect the ability of an individual to migrate, forage or rest. As explained in the pile driving section above, behavioral responses caused by TTS may meet the ESA definition of harassment but does not on its own meet the definition of harm. That is because, while TTS is expected to create the likelihood of injury by significantly disturbing normal behavioral patterns (i.e. ESA harassment) it is not likely to result in significant impairment of essential behavioral patterns that actually kill or injure any individuals (i.e. ESA harm).

As explained above, we have determined that due to the clearance procedures, we do not expect any exposure of any ESA listed whales to noise that could result in PTS. However, given the large area during which noise above the TTS threshold would be experienced, and that it exceeds the size of the clearance zone (with the exception of right whales, which trigger delay if detected at any distance) we cannot discount the potential for exposure that would result in TTS. We also note that due to the size of the area with noise above the TTS threshold it is unlikely that the visual PSOs will be able to detect all whales, including right whales, at the outer edges of the clearance zone, particularly if they are not vocalizing or are diving. As such, we anticipate that, as estimated by modeling, and as proposed to be authorized by OPR, up to 2 blue whale, 28 right whales, 49 fin whales, 16 sei whales, and 4 sperm whales may be exposed to noise during UXO detonations that may result in incidental take. As explained above, we have determined that the avoidance, minimization, and monitoring measures that are part of the proposed action (inclusive of those required as conditions of the proposed MMPA ITR and LOA) will be effective at reducing risk of exposure of blue, right, fin, sei, and sperm whales to noise that could result in

PTS such that it is extremely unlikely to occur. However, given the large distance to the TTS threshold we do not expect that the pre-clearance will eliminate all exposure of whales to the planned detonations. Therefore, we expect that up to 2 blue whale, 28 right whales, 49 fin whales, 16 sei whales, and 4 sperm whales will experience TTS as a result of exposure to UXO detonation noise. Consistent with the definitions and analysis presented above, we consider these effects to meet the definition of ESA take by harassment but not harm. The effects to individuals experiencing TTS are the same as those effects described above in the consideration of effects of pile driving noise. We expect recovery from the noise exposure to occur within hours to days (no more than a week) of exposure and that there would be no permanent effects to any individuals. In this case, the likelihood of injury is created by the change in hearing sensitivity (TTS), disruptions to resting, migrating, and feeding, increased stress and energetic consequences, and impacts on ability to detect and avoid threats that, together, are a significant disruption of normal behaviors. This disruption will persist for the duration of TTS and is not expected to last longer than 1 week or to be repeated in a single year (but may be repeated in subsequent construction years). These consequences will be greatest for any individuals that are already compromised due to existing injuries or entanglements and reproductive females.

As noted, NMFS defines “harm” for ESA take purposes as “an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding or sheltering.” No blue, fin, sei, or sperm whales will be injured or killed due to exposure to pile driving noise above the behavioral disturbance threshold but below the onset of auditory injury threshold. Further, while exposure to pile driving noise will significantly disrupt normal behaviors of individual whales on the day that the whale is exposed to the pile driving noise as well as for the period before TTS resolves (i.e., when hearing sensitivity returns to normal) creating the likelihood of injury, it will not actually kill or injure any individuals by significantly impairing any essential behavioral patterns. This is because behavioral disturbance, displacement, potential loss of foraging opportunities, and expending additional injury, will be limited to that short period of time and are expected to be fully recoverable, there will not be an effect on the animal’s overall energy budget in a way that would compromise its ability to successfully obtain enough food to maintain its health, or impact the ability of any individual to make seasonal migrations or participate successfully in nursing, breeding, or calving. Further, we expect that any increased risk of injury created by a reduced ability to detect or respond to threats will not result in any actual injury or mortality (i.e., we do not expect any vessel strike, entanglement, predator interactions, etc. to actually occur). TTS will resolve within no more than a week of exposure and is not expected to affect the health of any whale or its ability to migrate, forage, breed, calve, or raise its young. We also expect that stress responses will resolve with TTS and there will not be such an increase in stress that there would be physiological consequences to the individual that could affect its health or ability to socialize, migrate, forage, breed, calve, or raise its young. Thus, as no injury or mortality will actually occur, the response of right whales to pile driving noise does not meet the definition of “harm.”

Vessel Noise and Cable Installation

The frequency range for vessel noise (10 to 1000 Hz; MMS 2007) overlaps with the generalized hearing range for blue, sei, fin, and right whales (7 Hz to 35 kHz) and sperm whales (150 Hz to

160 kHz) and would therefore be audible. As described in the BA, vessels without ducted propeller thrusters would produce levels of noise of 150 to 170 dB re 1 µPa-1 meter at frequencies below 1,000 Hz, while the expected sound-source level for vessels with ducted propeller thrusters level is 177 dB (RMS) at 1 meter. For ROVs, source levels may be as high as 160 dB. Given that the noise associated with the operation of project vessels is below the thresholds that could result in injury, no injury is expected. Noise produced during cable installation is dominated by the vessel noise; therefore, we consider these together.

Marine mammals may experience masking due to vessel noises. For example, right whales were observed to shift the frequency content of their calls upward while reducing the rate of calling in areas of increased anthropogenic noise (Parks et al. 2007a) as well as increasing the amplitude (intensity) of their calls (Parks et al. 2011a; Parks et al. 2009). Right whales also had their communication space reduced by up to 84 percent in the presence of vessels (Clark et al. 2009a). Although humpback whales did not change the frequency or duration of their vocalizations in the presence of ship noise, their source levels were lower than expected, potentially indicating some signal masking (Dunlop 2016).

Vessel noise can potentially mask vocalizations and other biologically important sounds (e.g., sounds of prey or predators) that marine mammals may rely on. Potential masking can vary depending on the ambient noise level within the environment, the received level and frequency of the vessel noise, and the received level and frequency of the sound of biological interest. In the open ocean, ambient noise levels are between about 60 and 80 dB re 1 µPa in the band between 10 Hz and 10 kHz due to a combination of natural (e.g., wind) and anthropogenic sources (Urick 1983), while inshore noise levels, especially around busy ports, can exceed 120 dB re 1 µPa. When the noise level is above the sound of interest, and in a similar frequency band, masking could occur. This analysis assumes that any sound that is above ambient noise levels and within an animal's hearing range may potentially cause masking. However, the degree of masking increases with increasing noise levels; a noise that is just detectable over ambient levels is unlikely to cause any substantial masking.

Vessel noise has the potential to disturb marine mammals and elicit an alerting, avoidance, or other behavioral reaction. These reactions are anticipated to be short-term, likely lasting the amount of time the vessel and the whale are in close proximity (e.g., Magalhaes et al. 2002; Richardson et al. 1995d; Watkins 1981a), and not consequential to the animals. We also note that we do not anticipate any project vessels to occur within close proximity of any ESA listed whales; regulations prohibit vessels from approaching right whales closer than 500m and the vessel strike avoidance measures identified in Section 3.0 *Description of the Proposed Action* (inclusive of Appendix A and B) are expected to ensure no project vessels operate in close proximity to any whales in the action area. Additionally, short-term masking could occur. Masking by passing ships or other sound sources transiting the action area would be short term and intermittent, and therefore unlikely to result in any substantial costs or consequences to individual animals or populations. Areas with increased levels of ambient noise from anthropogenic noise sources such as areas around busy shipping lanes and near harbors and ports may cause sustained levels of masking for marine mammals, which could reduce an animal's ability to find prey, find mates, socialize, avoid predators, or navigate.

Based on the best available information, ESA-listed marine mammals are either not likely to respond to vessel noise or are not likely to measurably respond in ways that would significantly disrupt normal or essential behavior patterns that include, but are not limited to, breeding, feeding or sheltering. Therefore, the effects of vessel noise on ESA-listed marine mammals are insignificant (i.e., so minor that the effect cannot be meaningfully evaluated or detected).

Operation of WTGs
In considering the potential effects of operational noise on ESA listed whales we consider the expected noise levels from the operational turbines and the ambient noise (i.e., background noise that exists without the operating turbines) in the WDA. Ambient noise is a relevant factor because if the operational noise is not louder than ambient noise we would not expect an animal to react to it.

Ambient noise includes the combination of biological, environmental, and anthropogenic sounds occurring within a particular region. In temperate marine environments including the WDA, major contributors to the overall acoustic ambient noise environment include the combination of surface wave action (generated by wind), weather events such as rain, lightning, marine organisms, and anthropogenic sound sources such as ships. Kraus et al. (2016) surveyed the ambient underwater noise environment in the RI/MA WEA. Depending on location, ambient underwater sound levels within the RI/MA WEA varied from 96 to 103 dB in the 70.8- to 224-Hz frequency band at least 50% of the recording time, with peak ambient noise levels reaching as high as 125 dB in proximity to the Narraganset Bay and Buzzards Bay shipping lanes (Kraus et al. 2016). Low-frequency sound from large marine vessel traffic in these and other major shipping lanes to the east (Boston Harbor) and south (New York) were the dominant sources of underwater noise in the RI/MA WEA. Van Parijs et al. (2023) used PAM to document ambient noise near the southern New England wind lease areas; median broadband SPLs of all available data at each site ranged from 105 to 112 dB (re 1 μPa) with some variability among sites and years. Daily median broadband SPLs were variable within and among sites, ranging from 96 to 129 dB (re 1 μPa). Salisbury et al. 2018 monitored ambient noise off the coast of Virginia in consideration of the hearing frequencies of a number of marine mammal species. In the right whale frequency band (71-224 Hz), ambient noise exceeded 110 dB 50% of the time and 115 dB 14% of the time. Noise levels in the fin whale frequency band (18-28 Hz) were lower than the other whale species, with noise levels exceeding 100 dB 50% of the time.

As described above, many of the published measurements of underwater noise levels produced by operating WTGs range from older geared WTGs and are not expected to be representative of newer direct-drive WTGs, like those that will be installed for the SouthCoast project. Elliot et al. (2019) reports underwater noise monitoring at the BIWF, which has direct-drive GE Haliade 150-6 MW turbines; Elliott et al. (2019) notes that the direct-drive turbines measured at BIWF generated operational noise above background sound levels at the measurement location of 50 m (164 ft.) from the foundation. The authors also conclude that even in quiet conditions (i.e., minimal wind or weather noise, no transiting vessels nearby), operational noise at any frequency would be below background levels within 1 km (0.6 mi) of the foundation. This information suggests that in quiet conditions, a whale located within 1 km of the foundation may be able to detect operational noise above ambient noise conditions. However, given the typical ambient noise in the WDA, we expect these instances of quiet to be rare. Regardless, detection of the noise does not mean that there would be any effect to the individual.

Elliot et al. (2019) conclude that based on monitoring of underwater noise at the Block Island site, under most intense condition likely to occur, no risk of temporary or permanent hearing damage (PTS or TTS) could be projected even if an animal remained in the water at 50 m (164 ft.) from the turbine for a full 24-hour period. The loudest noise recorded by Elliot et al. (2019) was 126 dB re 1uPa at 50 m from the turbine when wind speeds exceeded 56 km/h; at wind speeds of 43.2 km/h and less, measured noise did not exceed 120 dB re 1uPa at 50 m from the turbine (Elliot et al. 2019). Based on wind speed records within the WDA (SouthCoast COP, Appendix X Table 7-1), wind speeds in the WDA exceed 55.6 kph (30 knots) less than 1% of the time; the 0-year mean wind speed at 10 m elevation is 7.2 m/s (26 kph or 14 kts). In a review of data from 27 operational wind farms in the North Sea (turbines between 2.3 and 8 MW), the mean (broadband) total SPL (SPL50 or L50) at nominal power of the turbines varied between 112 and 131 dB (median and mean value 120 dB) (Bellman et al. 2023). Bellman et al. (2023) also found that the low-frequency noise input from the wind turbine is no longer audible to individual marine mammals at distances of 100 m from the turbine. HDR 2023 found that noise levels recorded during the 6 MW CVOW turbine operations ranged from 120 to 130 dB re 1 μPa except during storms, when the received levels increased to 145 dB re 1 μPa. All recorded measurements were below the NMFS criteria for TTS and PTS for marine mammals. As described above these recent publications (Elliott et al. 2019, HDR 2023, Holme et al. 2023, and Bellman et al. 2023) are the best available scientific data for estimating operational noise of the SouthCoast turbines.

Given that conditions necessary to result in noise above 120 dB re 1uPa are expected to be rare (less than 5% of the time on an annual basis), and that in such windy conditions ambient noise is also increased, we do not anticipate the underwater noise associated with the operations noise of the direct-drive WTGs to result in avoidance of an area any larger than 50 – 100 m from the WTG foundation. As such, even if ESA-listed marine mammals avoided the area with noise above ambient, any effects would be so small that they could not be meaningfully measured, detected, or evaluated, and are therefore insignificant.

We recognize that the data from Elliot et al. (2019) represents WTGs that are of a smaller capacity than those proposed for use at the SouthCoast Project. We also recognize the literature that has predicted larger sound fields for larger turbines. However, we note that Bellman et al. (2023) did not identify a strong correlation between noise and the nominal power of the turbines (between 2.3 and 8.0 MW) and that even the papers that predict greater operational noise (Tougaard et al. (2020) and Stober and Thomsen (2021)) note that operational noise is less than shipping noise. The available information suggests that in areas with consistent vessel traffic, such as the SouthCoast WDA, operational noise is not expected to be detectable above ambient noise at a distance more than 50 – 100 m from the foundation. Additionally, while there are no studies documenting distribution of large whales in an area before and after construction of a wind farm, data from other marine mammals (harbor porpoise) indicates that any reduction in abundance in the wind farm area that occurred during the construction period resolves and that harbor porpoise are as abundant in the wind farm area during project operations as they were before. This supports our determination that effects of operational noise are likely to be insignificant.

HRG Survey Equipment
HRG surveys are planned within the lease area and cable routes and are elements of the proposed action under consultation in this opinion. A number of minimization measures for HRG surveys are also included as part of the proposed action. This includes maintenance of a 500 m clearance and shutdown zone for North Atlantic right whales and 100 m clearance and shutdown zone for other ESA listed marine mammals during the operations of equipment that operates within the hearing frequency of these species (i.e., less than 180 kHz).

In their ITA application, SouthCoast requested Level B harassment take associated with HRG surveys during the 5-year effective period of the ITA. During this period, HRG surveys are anticipated to operate at any time of year for a maximum of 112.5 active sound source days per year. The isopleth distances corresponding to the Level B harassment threshold for each type of HRG equipment with the potential to result in harassment of marine mammals were calculated per NMFS' Interim Recommendation for Sound Source Level and Propagation Analysis for HRG Sources. The distances to the 160 dB RMS re 1 μPa isopleth for Level B harassment are presented in Table 7.1.22 (see also Table 47 in the MMPA Proposed Rule). The MMPA ITA application contains a full description of the methodology and formulas used to calculate distances to the Level B harassment threshold. Horizontal impact distances to the onset of auditory injury threshold is less than 1 m from the source (BOEM 2021, using data from Crocker and Fratantonio 2016). As explained above, after the proposed rule was published, an updated source level for the sparker was considered (206 dB, rather than the 203 dB used in the ITA Application). Using a source level of 206 dB and formulas provided in NMFS (2020), the new estimated range to the 160 dB SPL Level B harassment threshold is 200 m, rather than the 141 m used in the proposed rule.

Table 7.1.30. Distances to the Level B Harassment Thresholds For Each HRG Sound Source Or Comparable Sound Source Category For Each Marine Mammal Hearing Group

Equipment Type	Representative Model	Level B (m)
		All (SPL_{rms})
Sub-bottom Profiler	EdgeTech 3100 with SB-216 towfish	4
	EdgeTech DW-106	3
	Knudson Pinger	6
	Teledyn Benthos CHIRP III - TTV 170	66
	Applied Acoustics Dura-Spark UHD (400 tips, 800 J)	200*
	Geomarine Geo-Spark (400 tips, 800 J)	200*
Boomer	Applied Acoustics triple plate S- Boom (700–1,000 J)	90

source: Table 47 89 FR 53708 and *additional information submitted during the consultation period

The basis for the MMPA take estimate is the number of marine mammals that would be exposed to sound levels in excess of the relevant TTS or behavioral disturbance threshold (160 dB or 120 dB). Typically, this is determined by estimating an ensonified area for the activity, by calculating the area associated with the isopleth distance corresponding to the Level B harassment threshold. This area is then multiplied by marine mammal density estimates in the project area and then corrected for seasonal use by marine mammals, seasonal duration of Project-specific noise-generating activities, and estimated duration of individual activities when the maximum noise-generating activities are intermittent or occasional. More information on the density estimates and calculations used are presented in the MMPA Proposed Rule.

As described in the Proposed Rule, SouthCoast requested the take of 5 blue, 24 fin, 10 sei, 23 North Atlantic right whales, and 10 sperm whales due to exposure to noise associated with HRG survey equipment during the five-year effective period of the ITA. NMFS OPR is proposing to authorize this take under the MMPA. As explained above, given the difference in the definitions between MMPA harassment and NMFS guidance defining take by harassment under the ESA, it is reasonable for NMFS OPR to find, in certain instances, that noise is likely to result in MMPA Level B harassment (i.e. potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns), while we determine that the intensity of those impacts is not severe enough to cause take by harassment under the ESA (i.e. create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns). As described below, we do not expect that exposure of any ESA listed whales to noise resulting from HRG surveys will result in any take as defined by the ESA. That is, we have determined that exposure of any ESA listed whales to noise above ESA behavioral harassment thresholds or at levels anticipated to cause take by harassment is extremely unlikely to occur. Further, if any exposure to noise resulting from HRG surveys were to occur, we expect the effects to be of very brief duration and marginal intensity causing only minor behavioral reactions and not TTS (i.e. so minor that they could not be detected, measured or evaluated: insignificant). We do not expect any effects to any ESA-listed whale's hearing to result from exposure to HRG noise sources. Based on these considerations, we have determined that all effects of exposure to HRG survey noise to be either insignificant or discountable. The basis for this conclusion is set forth below.

Extensive information on HRG survey noise and potential effects of exposure to ESA listed whales is provided in NMFS June 29, 2021 programmatic ESA consultation on certain geophysical and geotechnical survey activities (NMFS GAR 2021, inclusive of BOEM's 2021 BA) which we consider the best available science and information on these effects. We summarize the relevant conclusions here.

Based on the characteristics of the noise sources planned, no ESA listed whales are anticipated to be exposed to noise above the onset of auditory injury harassment thresholds (peak or cumulative). The peak noise threshold is not exceeded at any distance; the cumulative noise threshold is less than 1m. It is extremely unlikely that a whale would be close enough to the sound source to experience any exposure at all, and even less likely that it would experience sustained exposure. This is due to both the very small distance from the source that noise above the threshold extends (less than 1 m) and because the sound source is being towed behind a vessel and therefore is moving. Considering the sources that would be used for the surveys, the distance to the Level B harassment threshold extends up to approximately 200 m from the source. Given the very small area ensonified and considering the source is moving, any exposure of ESA listed whales to noise above the Level B harassment threshold is extremely unlikely to occur. The use of PSOs to monitor a clearance and shutdown zone (500 m for right whales and 100 m for other ESA listed whales) makes exposure even less likely to occur.

In the unlikely event that a whale did get within 200 m of the source (the maximum distance from the source where noise is above the Level B harassment threshold), we expect that the result of this exposure would be, at worst, temporary avoidance of the area with underwater noise louder than this threshold, which is a reaction that is considered to be of low severity and with no lasting biological consequences (e.g., Southall et al. 2008). The noise source itself will be moving. This means that any co-occurrence between a whale, even if stationary, and the noise source will be brief and temporary. Given that exposure will be short (no more than a few seconds, given that the noise signals themselves are short and intermittent and because the vessel towing the noise source is moving) and that the reaction to exposure is expected to be limited to changing course and swimming away from the noise source only far/long enough to get out of the ensonified area (200 m or less), the effect of this exposure and resulting response will be so small that it will not be able to be meaningfully detected, measured or evaluated and, therefore, is insignificant. Further, the potential for substantial disruption to activities such as feeding (including nursing), resting, and migrating is extremely unlikely given the very brief exposure to any noise (given that the source is traveling and the area ensonified at any given moment is so small). Any brief interruptions of these behaviors are not anticipated to have any lasting effects. Additionally, given the extremely short duration of any measurable behavioral disruption and the very small distance any animal would have to swim to avoid the noise it is extremely unlikely that the behavioral response would increase the risk of exposure to other threats including vessel strike or entanglement in fisheries gear. Thus, while we anticipate effects to be discountable as explained above, even in the extremely unlikely event that such effects were to occur, we anticipate the effects of these temporary behavioral changes to be so minor as to be insignificant. Insignificant and discountable effects are not adverse effects and thus cannot result in ESA take by harassment or otherwise.

In the Proposed Rule, NMFS OPR concluded that marine mammal communications would not likely be masked by the sub-bottom HRG survey equipment types planned for use for the types of surveys considered here and the brief period when an individual mammal is likely to be within its beam. Because effects of masking, if any, will be so small that they cannot be meaningfully measured, evaluated, or detected, any effects of masking on ESA-listed whales will be insignificant.

7.1.4 Effects of Project Noise on Sea Turtles

Background Information – Sea Turtles and Noise

Sea turtles are low frequency hearing specialists, typically hearing frequencies from 30 Hz to 2 kHz, with a range of maximum sensitivity between 100 to 800 Hz (Bartol and Ketten 2006, Bartol et al. 1999, Lenhardt 1994, Lenhardt 2002, Ridgway et al. 1969). Below, we summarize the available information on expected responses of sea turtles to noise.

Stress caused by acoustic exposure has not been studied for sea turtles. As described for marine mammals, a stress response is a suite of physiological changes that are meant to help an organism mitigate the impact of a stressor. If the magnitude and duration of the stress response is too great or too long, it can have negative consequences to the animal such as low reproductive rates, decreased immune function, diminished foraging capacity, etc. Physiological stress is typically analyzed by measuring stress hormones (such as cortisol), other biochemical markers, and vital signs. To our knowledge, there is no direct evidence indicating that sea turtles will experience a stress response if exposed to acoustic stressors such as sounds from pile driving. However, physiological stress has been measured for sea turtles during nesting, capture and handling (Flower et al. 2015; Gregory and Schmid 2001; Jessop et al. 2003; Lance et al. 2004), and when caught in entangling nets and trawls (Hoopes et al. 2000; Snoddy et al. 2009). Therefore, based on their response to these other anthropogenic stressors, and including what is known about cetacean stress responses, we assume that some sea turtles will exhibit a stress response if exposed to a detectable sound stressor.

Marine animals often respond to anthropogenic stressors in a manner that resembles a predator response (Beale and Monaghan 2004b; Frid 2003; Frid and Dill 2002; Gill et al. 2001; Harrington and Veitch 1992; Lima 1998; Romero 2004). As predators generally induce a stress response in their prey (Dwyer 2004; Lopez and Martin 2001; Mateo 2007), we assume that sea turtles may experience a stress response if exposed to acoustic stressors, especially loud sounds. We expect breeding adult females may experience a lower stress response, as studies on loggerhead, hawksbill, and green turtles have demonstrated that females appear to have a physiological mechanism to reduce or eliminate hormonal response to stress (predator attack, high temperature, and capture) in order to maintain reproductive capacity at least during their breeding season; a mechanism apparently not shared with males (Jessop 2001; Jessop et al. 2000; Jessop et al. 2004). We note that the only portion of the action area where breeding females may occur is the portion of the vessel transit routes south of Virginia and that presence is limited seasonally.

Based on the limited information about acoustically induced stress responses in sea turtles, it is reasonable to assume that physiological stress responses would occur concurrently with any other response such as hearing impairment or behavioral disruptions. However, we expect such responses to be brief, with animals returning to a baseline state once exposure to the acoustic source ceases. As with cetaceans, such a short, low-level stress response may in fact be adaptive and, in part, beneficial as it may result in sea turtles exhibiting avoidance behavior, thereby minimizing their exposure duration and risk from more deleterious, high sound levels.

Effects to Hearing

Interference, or masking, occurs when a sound is a similar frequency and similar to or louder than the sound an animal is trying to hear (Clark et al. 2009b; Erbe et al. 2016). Masking can interfere with an individual's ability to gather acoustic information about its environment, such as predators, prey, conspecifics, and other environmental cues (Richardson 1995). This can result in loss of environmental cues of predatory risk, mating opportunity, or foraging options. Compared to other marine animals, such as marine mammals, which are highly adapted to use sound in the marine environment, sea turtle hearing is limited to lower frequencies and is less sensitive. Because sea turtles likely use their hearing to detect broadband low-frequency sounds in their environment, the potential for masking would be limited to certain sound exposures. Only continuous anthropogenic sounds that have a significant low-frequency component, are not of brief duration, and are of sufficient received level could create a meaningful masking situation (e.g., long-duration vibratory pile extraction or long term exposure to vessel noise affecting natural background and ambient sounds); this type of noise exposure is not anticipated based on the characteristics of the sound sources considered here.

There is evidence that sea turtles may rely primarily on senses other than hearing for interacting with their environment, such as vision (Narazaki et al. 2013), magnetic orientation (Avens and Lohmann 2003; Putman et al. 2015), and scent (Shine et al. 2004). Thus, any effect of masking on sea turtles would likely be mediated by their normal reliance on other environmental cues.

Behavioral Responses

To date, very little research has been done regarding sea turtle behavioral responses relative to underwater noise. Popper et al. (2014) describes relative risk (high, moderate, low) for sea turtles exposed to pile driving noise and concludes that risk of a behavioral response decreases with distance from the pile being driven. O'Hara and Wilcox (1990) and McCauley et al. (2000b) experimentally examined behavioral responses of sea turtles in response to seismic airguns. O'Hara and Wilcox (1990) found that loggerhead turtles exhibited avoidance behavior at estimated sound levels of 175 to 176 dB re: 1 µPa (rms) (or slightly less) in a shallow canal. Mccauley et al. (2000a) experimentally examined behavioral responses of sea turtles in response to seismic air guns. Mccauley et al. (2000a) reported a noticeable increase in swimming behavior for both green and loggerhead turtles at received levels of 166 dB rms (re: 1 µPa). At 175 dB rms (re: one µPa), both green and loggerhead turtles displayed increased swimming speed and increasingly erratic behavior (Mccauley et al. 2000a). Based on these data, NMFS GARFO finds that sea turtles would exhibit a behavioral response in a manner that constitutes take by harassment, as defined for ESA take purposes above in this opinion, when exposed to received levels of 175 dB rms (re: 1 µPa) for a period long enough such that the behavioral response significantly disrupts normal behavioral patterns. This is the level at which sea turtles are expected to begin to exhibit avoidance behavior based on experimental observations of sea turtles exposed to multiple firings of nearby or approaching air guns.

7.1.4.1 Thresholds Used to Evaluate Effects of Project Noise on Sea Turtles

In order to evaluate the effects of exposure to noise by sea turtles that could result in physical effects, NMFS relies on the available literature related to the noise levels that would be expected to result in sound-induced hearing loss (i.e., TTS or PTS); we relied on acoustic thresholds for PTS and TTS for impulsive sounds developed by the U.S. Navy for Phase III of their programmatic approach to evaluating the environmental effects of their military readiness activities (U.S. Navy 2017a). At the time of this consultation, we consider these the best scientific information and data available since they rely on all available information on sea turtle hearing and employ the same methodology to derive thresholds as in NMFS 2018 technical guidance for auditory injury of marine mammals (NMFS 2018). Below we briefly detail these thresholds and their derivation. More information can be found in the U.S. Navy's Technical report on the subject (U.S. Navy 2017a).

To estimate received levels from airguns and other impulsive sources expected to produce TTS in sea turtles, the U.S. Navy compiled all sea turtle audiograms available in the literature in an effort to create a composite audiogram for sea turtles as a hearing group. Since these data were insufficient to successfully model a composite audiogram via a fitted curve as was done for marine mammals, median audiogram values were used in forming the hearing group's composite audiogram. Based on this composite audiogram and data on the onset of TTS in fishes, an auditory weighting function was created to estimate the susceptibility of sea turtles to TTS. Data from fish were used since there is currently no data on TTS for sea turtles and fish are considered to have hearing range more similar to sea turtles than do marine mammals (Popper et al. 2014). Assuming a similar relationship between TTS onset and PTS onset as has been described for humans and the available data on marine mammals, an extrapolation to PTS susceptibility of sea turtles was made based on the methods proposed by Navy 2017. From these data and analyses, dual metric thresholds were established similar to those for marine mammals: one threshold based on peak sound pressure level (0-pk SPL) that does not incorporate the auditory weighting function nor the duration of exposure, and another based on cumulative sound exposure level (SELcum) that incorporates both the auditory weighting function and the exposure duration (Table 7.1.31). The cumulative metric accumulates all sound exposure within a 24-hour period and is therefore different from a peak, or single exposure, metric.

Table 7.1.31. Acoustic thresholds identifying the onset of permanent threshold shift and Temporary threshold shift for sea turtles exposed to impulsive sounds (U.S. Navy 2017a)

Hearing Group	Generalized Hearing Range	Permanent Threshold Shift Onset	Temporary Threshold Shift Onset
Sea Turtles	30 Hz to 2 kHz	204 dB re: 1 $Pa^2 \cdot s$ SEL_{cum} 232 dB re: 1 μPa SPL (0-pk)	189 dB re: 1 $\mu Pa^2 \cdot s$ SEL_{cum} 226 dB re: 1 μPa SPL (0-pk)

Non-auditory Injury Criteria for Explosives (Unexploded Ordnance)
NMFS has independently reviewed and adopted criteria used by the U.S. Navy to assess the potential for non-auditory injury (i.e., lung and GI tract) and mortality from underwater explosive sources as presented in U.S. Navy (2017) and considers it the best available science. Unlike auditory thresholds, these depend upon an animal's mass and depth. Table 7.1.24 provides mass estimates used in the assessment. For sea turtles, harbor seal (*Phoca vitulina*) pup and adult masses are used as conservative surrogate values as outlined in U.S. Navy (2017).

Single blast events within a 24-hour period are not presently considered by NMFS to produce behavioral effects if they are below the onset of TTS thresholds for frequency-weighted SEL (LE,24h) and peak pressure levels. As only one charge detonation per day is planned for the Project, the effective disturbance threshold for single events in each 24-hour period is the TTS onset.

Table 7.1.32 Representative Pup and Adult Mass Estimates Used for Assessing Impulse-based Onset of Lung Injury and Mortality Threshold Exceedance Distances

Impulse Animal Group	Representative Species	Pup Mass (kg)	Adult Mass (kg)
Sea Turtles	Harbor Seal (*Phoca vitulina*)	8	60

Note: These values are based on the smallest expected animals for the species that might be present within Project areas. Masses listed here are used for assessing impulse-based onset of lung injury and mortality threshold exceedance distances.
kg = kilograms

Hearing Group	Mortality (Severe lung injury)*	Slight Lung Injury*	G.I. Tract Injury
Sea Turtles	*Cell 1* Modified Goertner model; Equation 1	*Cell 2* Modified Goertner model; Equation 2	*Cell 3* Lpk,flat: 237 dB

* Lung injury (severe and slight) thresholds are dependent on animal mass (Recommendation: Table C.9 from DoN 2017 based on adult and/or calf/pup mass by species).

Modified Goertner Equations for severe and slight lung injury (pascal-second)

Equation 1: $103M^{1/3}(1 + D/10.1)^{1/6}$ Pa-s

Equation 2: $47.5M^{1/3}(1 + D/10.1)^{1/6}$ Pa-s

M animal (adult and/or juvenile) mass (kg) (Table C.9 in DoN 2017)
D animal depth (meters)

Criteria for Considering Behavioral Effects

For assessing behavioral effects in the BA, BOEM used the 175 dB re 1uPa RMS criteria based on McCauley et al. (2000b), consistent with NMFS recommendations; this is also considered in the lessee's acoustic modeling (Küsel et al. 2023, Limpert et al. 2024). This level is based upon work by Mccauley et al. (2000a), who experimentally examined behavioral responses of sea turtles in response to seismic air guns. The authors found that loggerhead turtles exhibited avoidance behavior at estimated sound levels of 175 to 176 dB rms (re: 1 µPa), or slightly less, in a shallow canal. Mccauley et al. (2000a) reported a noticeable increase in swimming behavior for both green and loggerhead turtles at received levels of 166 dB rms (re: 1 µPa). At 175 dB rms (re: 1 µPa), both green and loggerhead turtles displayed increased swimming speed and increasingly erratic behavior (Mccauley et al. 2000a). Based on these data, NMFS expects sea turtles would exhibit a behavioral response when exposed to a received level of 175 dB rms (re: 1 µPa). This is the level at which sea turtles are expected to begin to exhibit avoidance behavior based on experimental observations of sea turtles exposed to multiple firings of nearby or approaching air guns. Because data on sea turtle behavioral responses to pile driving is limited, the air gun data set is used to inform potential risk.

7.1.4.2 Effects of Project Noise on Sea Turtles

Here, we consider the effects of the noise producing activities of the SouthCoast project in the context of the noise thresholds presented above.

Impact and Vibratory Pile Driving for WTG and OSP Foundation Installation

Modeling was carried out to determine distances to the onset of auditory injury (PTS) and behavioral disruption thresholds for sea turtles exposed to pile driving sound for the different foundation installation scenarios (Limpert et al. 2024). Similar to the results presented for marine mammals, the exposure ranges (ER95%) for sea turtles were modeled at two locations, assuming 10 dB broadband attenuation, and both winter and summer acoustic propagation environments (Limpert et al. 2024). Average summer and winter sound speed profiles representative of the area where pile driving would occur were used for the acoustic propagation modeling. The summer sound profile is presented here because it represents the period when sea turtle exposure to pile driving noise is expected to occur; we also note that pile driving is not authorized in any portion of the lease area from January - April. For the sound exposure level (SEL, cumulative exposure) criteria, acoustic energy was accumulated for all pile driving strikes in a 24 hour period. Exposure ranges vary between species due to differences in their behavior (e.g., swim speeds, dive depths). These differences can impact both dwell time and how the animats (i.e., simulated animals) sample the sound field. As explained above, for modeled animals that have received enough acoustic energy to exceed a given threshold, the exposure range for each animal is defined as the closest point of approach (CPA) to the source made by that animal while it moved throughout the modeled sound field, accumulating received acoustic energy. The resulting exposure range for each species is the 95th percentile of the CPA distances for all animals that exceeded threshold levels for that species, this is referred to as the 95 percent exposure range ($ER_{95\%}$).

Modeling to the onset of injury (peak and cSEL) and behavioral disturbance thresholds was carried out for the following scenarios:

- sequential impact pile driving: 16 m monopile foundation, one pile per day; 16 m monopile foundation, two piles per day; 4.5 m pre-piled jacket foundation, four piles per day; 4.5 m post-piled jacket foundation, four piles per day;
- concurrent impact pile driving: 16 m monopile, one pile per day and 4.5 m post-piled jacket foundation, four piles per day; 4.5 m pre-piled jacket foundation, four piles per day and 4.5 m post-piled jacket foundation four piles per day; (Note that this scenario would only occur on the up to four days per project that both WTG and OSP piles are installed on the same day).
- vibratory pile setting followed by impact hammer: 16 m monopile, one pile per day; 16 m monopile, two piles per day; 4.5 m pre-piled jacket foundation, 4 piles per day. (Note that this scenario is relevant for Project 2 only as vibratory pile setting is not part of the proposed action for Project 1).

See section 4.4.2 in Limpert et al. 2024 for complete tables; also summarized in Table 5.2-7 of BOEM's BA. Modeling to calculate distances to the TTS threshold was not carried out for pile driving.

As noted in the marine mammal section above, two construction scenarios are proposed for Project 1 (all WTG monopile foundations or all WTG jacket foundations, impact pile driving only with OSPs on jacket foundations) and three construction scenarios are proposed for Project 2 (all WTG monopile foundations or all WTG jacket foundations, all impact pile driving or a combination of vibratory and impact pile driving, all OSPs on jacket foundations). In all construction scenarios, concurrent pile driving (i.e., two piles installed at the same time) is only proposed for the limited number of days (not to exceed 4 for each project), when WTG and OSP foundations are installed on the same day (one monopile and four pin piles).

Based on the modeling, noise is not expected to exceed the peak injury criteria (232 dB) during any impact or vibratory pile driving for the SouthCoast project (Limpert et al. 2024). Additionally, noise is not expected to exceed the cumulative injury criteria during any vibratory pile setting. The modeling results to the onset of injury (cSEL, Tables 7.1.33 and 7.1.34) and behavioral thresholds (Table 7.1.35) for the potential construction scenarios for Project 1 and Project 2 are presented below.

Table 7.1.33. Project 1. Exposure ranges (ER95%, CPA, in km) to injury (SEL_{cum}[1]) thresholds for sea turtles under different WTG and OSP pile driving installation scenarios, assuming 10 dB of noise attenuation (largest distance to CPA for two modeled locations and summer sound profile).

Species	Project 1					
	Concurrent Installation of WTG Foundation and OSP Jacket Foundation (impact only)		Sequential Installation of Piles (impact only)			
	16 m WTG Monopile and 4.5 m OSP Jacket	4.5 m WTG JPP and 4.5 m OSP Jacket	16 m WTG Monopile 1 pile/day	16 m WTG Monopile 2 piles/day	4.5 m WTG Jacket 4 piles/day	4.5 m OSP Jacket 4 piles/day
Kemp's ridley turtle	0.35	0.03	0.18	0.39	0	0.13
Leatherback turtle	0.99	0.45	1	0.89	0.37	0.57
Loggerhead turtle	0.22	0	0.01	0.13	0	0
Green turtle	0.6	0.2	0.48	0.55	0.15	0.15

dB = decibel; km = kilometer; m = meter; JPP = jacket pin piles; WTG = wind turbine generators; OSP = offshore service platform
[1] SEL_{cum} = weighted cumulative sound exposure level in decibels referenced to 1 microPascal squared second; also written L_E
Source: Summarized from Tables 41 – 49 (Limpert et al. 2024)

Table 7.1.34 Project 2. Exposure ranges (ER95%, CPA, in km) to injury (SEL_{cum}[1]) thresholds for sea turtles under different WTG and OSP pile driving installation scenarios, assuming 10 dB of noise attenuation (largest distance to CPA for two modeled locations and summer sound profile)

Species	Project 2								
	Concurrent Installation of WTG and OSP Foundation (impact only)		Sequential Installation of Piles (impact + vibratory)			Sequential Installation of Piles (impact only)			
	16 m WTG Monopile and 4.5 m OSP jacket	4.5 m WTG JPP and 4.5 m OSP jacekt	16 m WTG Monopile 1 pile/day	16 m WTG Monopile 2 piles/day	4.5 m WTG jacket 4 piles/day	16 m WTG Monopile 1 pile/day	16 m WTG Monopile 2 piles/day	4.5 m WTG jacket 4 piles/day	4.5 m OSP jacket 4 piles/day
Kemp's ridley turtle	0.35	0.03	0.2	0.39	0	0.18	0.39	0	0.13
Leatherback turtle	0.99	0.45	1	0.89	0.39	1	0.89	0.37	0.57

Species	Project 2								
	Concurrent Installation of WTG and OSP Foundation (impact only)		Sequential Installation of Piles (impact + vibratory)			Sequential Installation of Piles (impact only)			
	16 m WTG Monopile and 4.5 m OSP jacket	4.5 m WTG JPP and 4.5 m OSP jacekt	16 m WTG Monopile 1 pile/day	16 m WTG Monopile 2 piles/day	4.5 m WTG jacket 4 piles/day	16 m WTG Monopile 1 pile/day	16 m WTG Monopile 2 piles/day	4.5 m WTG jacket 4 piles/day	4.5 m OSP jacket 4 piles/day
Loggerhead turtle	0.22	0	0.01	0.02	0	0.01	0.13	0	0
Green turtle	0.6	0.2	0.49	0.55	< 0.01	0.48	0.55	0.15	0.15

dB = decibel; km = kilometer; m = meter; JPP = jacket pin piles; WTG = wind turbine generators; OSP = offshore service platform
[1] SEL_{cum} = weighted cumulative sound exposure level in decibels referenced to 1 microPascal squared second; also written L_E
Source: Summarized from Tables 41 – 49 (Limpert et al. 2024)

Table 7.1.35 Project 1 and 2. Exposure ranges (ER95%, CPA, in km) to behavioral threshold (175 dB) for sea turtles under different WTG and OSP pile driving installation scenarios, assuming 10 dB of noise attenuation (largest distance to CPA for two modeled locations and summer sound profile

Species									
	Concurrent Installation of WTG and OSP Foundation (impact only)		Sequential Installation of Piles (impact + vibratory)			Sequential Installation of Piles (impact only)			
	16 m WTG Monopile and 4.5 m OSP jacket	4.5 m WTG JPP and 4.5 m OSP jacket	16 m WTG Monopile 1 pile/day	16 m WTG Monopile 2 piles/day	4.5 m WTG jacket 4 piles/day	16 m WTG Monopile 1 pile/day	16 m WTG Monopile 2 piles/day	4.5 m WTG jacket 4 piles/day	4.5 m OSP jacket 4 piles/day
Kemp's ridley turtle	1.68	0.78	1.75	1.72	0.63	1.78	1.70	0.61	0.86
Leatherback turtle	1.66	0.99	2.11	2.01	0.65	2.11	2.01	0.65	0.99
Loggerhead turtle	1.39	0.70	1.48	1.33	0.56	1.50	1.46	0.50	0.86
Green turtle	1.89	0.78	1.70	1.93	0.64	1.70	1.95	0.68	0.87

Source: Summarized from Tables 41 – 49 (Limpert et al. 2024)

Animal movement modeling was carried out to predict the numbers of individual sea turtles that would receive sound levels above threshold criteria (Limpert et al. 2024). Limpert et al. (2024) used the JASCO Animal Simulation Model Including Noise Exposure (JASMINE) to predict the exposure of animats (virtual sea turtles) to sound arising from sound sources. An individual animat's modeled sound exposure levels are summed over the total simulation duration, such as 24 hours or the entire simulation, to determine its total received energy, and then compared to the assumed threshold criteria. The tables below include results assuming broadband attenuation of 10 dB for impact pile driving with maximum seasonal densities for each species (as described below). No aversion behaviors (e.g., avoidance) or mitigation measures (e.g., shutdown zones) other than the 10 dB attenuation for impact pile driving were incorporated into the modeling to generate the number of sea turtles of each species that are expected to be exposed to the noise.

As described in Limpert et al. (2024), there are limited density estimates for sea turtles in the WDA. For the modeling, sea turtle densities were obtained from the US Navy Operating Area Density Estimate (NODE) database on the Strategic Environmental Research and Development Program Spatial Decision Support System (SERDP-SDSS) portal (DoN, 2012, 2017) and from the Northeast Large Pelagic Survey Collaborative Aerial and Acoustic Surveys for Large Whales and Sea Turtles (Kraus et al. 2016). These data are summarized seasonally (winter, spring, summer, and fall).

Sea turtles were most commonly observed in summer and fall, absent in winter, and nearly absent in spring during the Kraus et al. (2016) surveys of the MA WEA and RI/MA WEAs (which includes the SouthCoast lease area where pile driving will occur); this is consistent with expected seasonal distribution of sea turtles in New England waters. SERDP-SDSS densities are provided as a range, where the maximum density will always exceed zero, even though turtles are unlikely to be present in winter. Because of this, the winter and spring densities from SERDP-SDSS were used for all species. As a result, winter and spring sea turtle densities in the WDA, while low, are likely still overestimated.

For summer and fall, the more recent leatherback and loggerhead densities extracted from Kraus et al. (2016) were used. These species were the most commonly observed sea turtle species during aerial surveys by Kraus et al. (2016) in the MA/RI and MA WEAs. However, Kraus et al. (2016) reported seasonal densities for leatherback sea turtles only, so the loggerhead densities were calculated for summer and fall by scaling the averaged leatherback densities from Kraus et al. (2016) by the ratio of the seasonal sighting rates of the two species during the surveys. The Kraus et al. (2016) estimates of loggerhead sea turtle density for summer and fall are slightly higher than the SERDP-SDSS densities. Kraus et al. (2016) reported only six total Kemp's ridley sea turtle sightings, so the estimates from SERDP-SDSS were used for all seasons. Green sea turtles are rare in this area and there are no density data available for this species, so the Kemp's ridley sea turtle density is used as a surrogate; this is reasonable based on the known distribution of Green sea turtles in New England waters.

Table 7.1.36. Sea turtle density estimates for the SouthCoast lease area plus a 5 km buffer.

Species	Density (animals/100km^2)			
	Spring	*Summer*	*Fall*	*Winter*
Kemp's ridley sea turtle	0.006	0.006	0.006	0.006
Leatherback sea turtle	0.027	0.630[a]	0.873[a]	0.027
Loggerhead sea turtle	0.076	0.206[b]	0.633[b]	0.076
Green sea turtle [c]	0.006	0.006	0.006	0.006

Source: Limpert et al. 2024 (table 21)

Density estimates are extracted from SERDP-SDSS NODE database within a 5 km perimeter range of the lease area, unless otherwise noted.

[a] Densities calculated as averaged seasonal densities from 2011 to 2015 (Kraus et al. 2016).
[b] Densities calculated as the averaged seasonal leatherback sea turtle densities scaled by the relative, seasonal sighting rates of loggerhead and leatherback sea turtles (Kraus et al. 2016).
[c] Kraus et al. (2016) did not observe any green sea turtles in the RI/MA WEA. Densities of Kemp's ridley sea turtles are used as a proxy.

As explained in the *Status of the Species* and *Environmental Baseline* sections of this Opinion, due to seasonal water temperature patterns, sea turtles are most likely to occur in the WDA from June through October, with few sea turtles present in May, November, and early December and turtles absent in the winter months (January – April); thus, while the density estimates suggest the presence of sea turtles year round, sea turtles are extremely unlikely to occur from January to April due to cold water temperatures.

We considered whether sufficient information was available on detection rates from aerial surveys from which we could further adjust the density or exposure estimates. Kraus et al. (2016) notes that the number of sea turtle sightings was substantially increased by detections in the vertical camera (mounted under the plane) compared to the number observed by observers using binoculars during the aerial survey but does not provide any information on overall sea turtle detectability nor does it adjust observations to account for availability bias.

Some studies have concurrently conducted tagging studies to account for availability bias. We reviewed the literature for similar studies conducted in the lease area, however no studies were found. The closest geographic study, NEFSC 2011, estimated regional abundance of loggerhead turtles in Northwestern Atlantic Ocean continental shelf waters using aerial surveys and accounted for availability bias using satellite tags. However, as determining availability bias depends on the species and is influenced by habitat, season, sea surface temperature, time of day, and other factors, we determined that while we may be able to identify studies that identified availability bias (such as NEFSC 2011) it would not be reasonable to apply those post-hoc to the density estimates given differences in the study designs, location, habitat, sea surface temperature, etc.

We also considered whether it would be reasonable to adjust the density estimates to account for the percent of time that sea turtles are likely to be at the surface while in the WDA and therefore would be available to be detected for such a survey. However, after consulting with subject matter experts we determined it was not reasonable to adjust the density estimates with general observations about the amount of time sea turtles may be spending at the surface. Therefore, we have determined that there is no information available for us to use that could result in a different estimate of the amount of exposure that is reasonably certain to occur and have not made any further adjustments to the exposure estimates. As such, the density estimates provided in Küsel et al. (2023) as derived from the cited data sources are considered the best available scientific information.

Considering all construction scenarios, no sea turtles are expected to be exposed to noise above the peak auditory injury (PTS) threshold; this is because noise during pile driving is not expected to exceed the peak injury (PTS) threshold in any scenario proposed for the project (Limpert et al. 2024). The tables below contain the modeled number of sea turtles predicted to be exposed to noise above the injury and behavioral thresholds for Project 1 and Project 2. These estimates do not account for any aversion behavior (i.e., avoidance of pile driving noise) and they do not incorporate the clearance or shutdown zones. These estimates consider the area ensonified above the identified threshold, the number of days of foundation installation, and the density estimates outlined above.

Table 7.1.37. Project 1: Number of sea turtles predicted to be exposed to noise above the injury and behavioral disturbance criteria for all monopile and all jacket scenario (impact pile driving only)

Species	Monopile Scenario			Jacket Scenario		
	Individuals Exposed to Noise above the Injury (PTS) threshold		Individuals Exposed to Noise above the 175 dB threshold (TTS and/or Behavioral Effects)	Individuals Exposed to Noise above the Injury (PTS) threshold		Individuals Exposed to Noise above the 175 dB threshold (TTS and/or Behavioral Effects)
	Peak	cSEL		Peak	cSEL	
Kemp's ridley	0	<0.01	0.12	0	<0.01	<0.01
Leatherback	0	2.03	5.69	0	0.59	1.77
Loggerhead	0	0.10	3.83	0	0	3.45
Green	0	<0.01	0.10	0	<0.01	<0.01

source: Tables 29-31, Limpert et al. 2024

Table 7.1.38. Project 2: Number of sea turtles predicted to be exposed to noise above the injury and behavioral disturbance criteria for all monopile (impact only and impact/vibratory) and all jacket scenario (impact/vibratory pile driving)

Species	Monopile Scenario – Impact Only			Monopile – Impact/Vibratory			Jacket Scenario		
	Individuals Exposed to Noise above the Injury (PTS) threshold		Individuals Exposed to Noise above the 175 dB threshold (TTS and/or Behavioral Effects)	Individuals Exposed to Noise above the Injury (PTS) threshold		Individuals Exposed to Noise above the 175 dB threshold (TTS and/or Behavioral Effects)	Individuals Exposed to Noise above the Injury (PTS) threshold		Individuals Exposed to Noise above the 175 dB threshold (TTS and/or Behavioral Effects)
	Peak	cSEL		Peak	cSEL		Peak	cSEL	
Kemp's ridley	0	<0.01	0.11	0	<0.01	0.12	0	<0.01	<0.01
Leatherback	0	1.97	5.71	0	2.31	6.25	0	0.40	1.25

Loggerhead	0	0.12	4.03	0	0.19	4.29	0	0	2.60
Green	0	<0.01	0.10	0	<0.01	0.11	0	<0.01	<0.01

source: Tables 29-31, Limpert et al. 2024

In the table below we present the modeled exposures as whole numbers. We have rounded up fractions to whole animals with the exception that fractions less than 0.1 have been rounded down to zero as we consider modeled exposures at that level extremely unlikely to occur. No sea turtles are expected to be exposed to noise above the peak PTS threshold in any scenario. Considering the SouthCoast pile driving installation as a whole (Project 1 and 2), modeling predicts the exposure of up to 5 leatherback and 2 loggerhead sea turtles to pile driving noise above the onset of injury (PTS) threshold an up to 2 Kemp's ridley, 13 leatherback, 9 loggerhead, and 2 green sea turtles to noise above the behavioral disturbance threshold.

Table 7.1.39. Maximum predicted exposure for each sea turtle species – Project 1 and Project 2 Combined (147 WTGs, 2 OSPs)

Species	Project 1		Project 2		Total	
	Individuals Exposed to Noise above the Injury (PTS) threshold	Individuals Exposed to Noise above the 175 dB threshold (TTS and/or Behavioral Effects)	Individuals Exposed to Noise above the Injury (PTS) threshold	Individuals Exposed to Noise above the 175 dB threshold (TTS and/or Behavioral Effects)	Individuals Exposed to Noise above the Injury (PTS) threshold	Individuals Exposed to Noise above the 175 dB threshold (TTS and/or Behavioral Effects)
Kemp's ridley	0	1	0	1	0	2
Leatherback	2	6	3	7	5	13
Loggerhead	1	4	1	5	2	9
Green	0	1	0	1	0	2

Proposed Measures to Minimize Exposure of Sea Turtles to Pile Driving Noise

Here, we consider the measures that are part of the proposed action, because they are proposed by SouthCoast or BOEM and are reflected in the proposed action as described to us by BOEM in the BA, or they are required through the conditions of COP approval or ITA (recognizing that some measures required for marine mammals may provide benefit to sea turtles). Specifically, we consider how those measures will serve to minimize exposure of ESA listed sea turtles to pile driving noise. Details of these proposed measures are included in the Description of the Action section above. We do not consider the use of PAM here; because sea turtles do not vocalize, PAM cannot be used to monitor sea turtle presence. We note that during the consultation period, BOEM clarified that references in the BA to use of PAM as a monitoring measure for sea turtles were made in error.

Seasonal Restriction on Pile Driving

No pile driving would occur between January 1 and May 15 in any part of the lease and would not occur between October 16 and May 31 in the NARW EMA to avoid the time of year with the highest densities of right whales in the project area. The January 1 – April 30 period overlaps with the period when we do not expect sea turtles to occur in the action area due to cold water temperatures. The seasonal restrictions are factored into the acoustic modeling that supported the development of the exposure estimates above. Thus, the exposure estimates do not need to be adjusted to account for this seasonal restriction.

Sound Attenuation Devices

SouthCoast will implement sound attenuation measures that are designed and projected to achieve at least a 10 dB reduction in pile driving noise, as described above. The attainment of a 10 dB reduction in pile driving noise was incorporated into the exposure estimate calculations presented above. Thus, the exposure estimates do not need to be adjusted to account for the use of sound attenuation. If a reduction greater than 10 dB is achieved, the number of sea turtles exposed to pile driving noise could be lower as a result of resulting smaller distances to thresholds of concern.

As described above, SouthCoast will conduct thorough hydroacoustic monitoring (sound field verification) for a subset of each pile type and installation methodology and abbreviated SFV for any piles installed without through SFV. The required sound field verification will provide information necessary to confirm that the sound source characteristics predicted by the modeling are reflective of actual sound source characteristics in the field. If noise levels are higher than predicted by the modeling described here (i.e., measured distances exceed the distances to the peak and/or cumulative injury and/or behavioral disturbance thresholds identified in table 7.1.25 and 7.1.26), additional or alternative/modified noise attenuation measures or operational changes (e.g., reduced hammer energy) will be implemented to reduce noise and avoid exceeding the modeled distances to the injury and behavioral disturbance thresholds that were analyzed here. In the event that noise attenuation measures and/or adjustments to pile driving cannot reduce the distances to less than those modeled (assuming 10 dB attenuation), this would indicate the amount or extent of take specified in the incidental take statement might be exceeded and/or constitute new information that reveals effects of the action that may affect listed species in a manner or to an extent not previously considered and reinitiation of this consultation is expected such that reinitiation of consultation would be necessary (see 50 CFR 402.16).

Clearance and Shutdown Zone

During the consultation period, BOEM clarified that the proposed clearance and shutdown zone for sea turtles that would need to be monitored prior to and during pile driving is 200 m, with steps outlined for delay and shutdown of pile driving. As proposed by BOEM, SouthCoast would use PSOs to establish clearance zones (200 m around the pile being driven) to ensure the area is clear of sea turtles prior to the start of pile driving. Consistent with the proposed conditions of COP approval, SouthCoast must have sufficient PSOs to effectively monitor the clearance and shutdown zone. In the proposed ITR, NMFS OPR is requiring at least 3 on-duty

PSOs on each monitoring platform, which will include the pile driving vessel as well as three to four additional PSO-dedicated vessels, depending on location and time of year. The PSOs located on the pile driving vessel would be required to monitor the 200 m clearance/shutdown zone for sea turtles. Prior to the start of pile driving activity, the 200 m clearance zone will be monitored for 60 minutes for protected species including sea turtles. If a sea turtle is observed approaching or entering the clearance zone prior to the start of pile driving operations, pile driving activity will be delayed until either the sea turtle has voluntarily left the respective clearance zone and been visually confirmed beyond that clearance zone, or, 30 minutes have elapsed without re-detection of the animal. Sea turtles observed within a clearance zone will be allowed to remain in the clearance zone (*i.e.*, must leave of their own volition), and their behavior will be monitored and documented. The clearance zones may only be declared clear, and pile driving started, when the entire clearance zone is visible (*i.e.*, when not obscured by dark, rain, fog, etc.) for a full 30 minutes prior to pile driving. As required by conditions of the proposed ITR, a "minimum visibility zone" must be fully visible to the PSOs (i.e., not obscured by fog, rain, sea state, or other conditions) for a full 30 minutes before soft-start pile driving can begin; this minimum visibility zone is dependent on the pile type, location, and time of year and ranges from 1,900 m to 7,400 m. If a sea turtle is observed entering or within the 200 m clearance zone after pile driving has begun, the PSO will request a temporary cessation of pile driving as explained for marine mammals above; if shutdown is not possible due to safety reasons, reduced hammer energy will be implemented.

As noted above, there will be at least three PSOs stationed at an elevated position at or near the pile being driven and at least three PSOs on each of at least three vessels transiting around the pile at a distance that will allow effective monitoring of the entirety of the clearance zones. Given that PSOs will be at an elevated position and that pile driving can only begin if the entirety of the clearance zone can be effectively monitored (i.e., not obscured by fog, rain, sea state, or other conditions), we expect that during the daytime, the PSOs will be able to detect sea turtles located at the surface that are within 500 m from the monitoring platform. However, under low visibility conditions or after dark, we expect that ability to detect sea turtles would not be reliable beyond 200-300 m (depending on sea state and based on use of enhanced deck and construction lighting and absent any new technology that may enhance detectability of sea turtles in low light conditions). As such, during all conditions that pile driving will occur, we expect that the PSOs from the pile driving platform will be able to effectively monitor the 200 m clearance zone and that the PSOs on the PSO vessel will provide additional information on sea turtles detected outside the clearance zone. While visibility of sea turtles in the clearance zone is limited to only sea turtles at or very near the surface, we expect that the use of the clearance zone will reduce the number of times that pile driving begins with a sea turtle closer than 200 m to the pile being driven. The single strike PTS (peak) threshold will not be exceeded during any pile driving; thus, injury is not expected to occur even if a sea turtle was within the clearance zone for long enough to be exposed to a single impact pile strike. Similarly, the PTS (peak or cumulative) threshold will not be exceeded during any vibratory pile driving; thus, injury is not expected to occur even in the unexpected instance that a sea turtle was within the clearance zone for the duration of vibratory pile setting.

Here we consider how the clearance and shutdown requirements may reduce the potential exposure of individual sea turtles to noise above the injury and behavioral disturbance thresholds. For all pile driving scenarios, the CPA for behavioral disturbance is well outside the 200 m clearance and shutdown distance (0.70 -2.11 km); that is, a sea turtle would be exposed to noise above the behavioral disturbance threshold outside of the clearance/shutdown zone. Therefore, we are not adjusting the modeled exposures of sea turtles above behavioral thresholds to account for the clearance or shutdown procedures as we do not expect clearance or shutdown to prevent exposure of sea turtles to noise above the behavioral disturbance threshold. As noted above, for vibratory pile setting, the PTS threshold (peak or cumulative) is not exceeded at any distance. For impact pile driving, the exposure range for the cumulative injury threshold for Kemp's ridley, loggerhead, leatherback, and green sea turtles is greater than 200 m in at least some pile scenarios. That is, in some pile driving scenarios, the modeled CPA (i.e., the closest point of approach to a pile being installed that would indicate an individual sea turtle had accumulated enough noise exposure to experience PTS) is greater than 200 m, with the largest distance up to 1 km. Given this and the limitations of only being able to detect sea turtles at the surface, the clearance procedures may not eliminate exposure of sea turtles to pile driving noise that could result in PTS (i.e., we expect that pile driving could begin with a sea turtle closer than 200 m to the pile). Similarly, this means that shutdown may not be called for in time for prevention of exposure to noise that is modeled to result in PTS. As such, while we expect the clearance and shutdown procedures will minimize the potential for starting pile driving when there is a sea turtle within 200 m of the pile and may reduce the duration of exposure to noise above the PTS threshold, we do not expect that these requirements will eliminate the potential for exposure of some sea turtles to noise above the PTS threshold.

Soft Start

Soft start procedures can provide a warning to animals or provide them with a chance to leave the area prior to the hammer operating at full capacity. As described above, for impact pile driving before full energy pile driving begins, pile driving will occur at a reduced hammer energy for a minimum of 20 minutes. Even at full hammer energy, no sea turtles would be be exposed to noise above the peak PTS threshold (see Table 7.1.35 above). The use of the soft start gives sea turtles near enough to the piles to be exposed to the soft start noise a "head start" on escape or avoidance behavior by causing them to swim away from the source. This means that sea turtles that are close enough to the pile to be exposed to noise above 175 dB (0.70 -2.11 km) of the pile would be expected to begin to swim away from the noise before full force pile driving begins; in this case, the number of sea turtles exposed to noise that may result in injury would be reduced. It is likely that by eliciting avoidance behavior prior to full power pile driving, the soft start will reduce the duration of exposure to noise that could result in behavioral disturbance. Without soft start procedures, pile driving would begin with full hammer energy, which would present a greater risk of more severe impacts to more animals. In this context, soft start is a mitigation measure designed to reduce the amount and severity of effects incidental to pile driving. However, we are not able to predict the extent to which the soft start will reduce the number of sea turtles exposed to pile driving noise or the extent to which it will reduce the duration of exposure. Therefore, while the soft start is expected to reduce effects of pile driving, we are not able to modify the estimated exposures to account for any benefit provided by the soft start.

7.1.4.1 Effects to Sea Turtles Exposed to Impact Pile Driving Noise for Foundation Installation

As noted above, modeling indicates the peak PTS threshold is not exceeded in any pile driving scenario. Modeling predicts the cumulative PTS threshold is only exceeded during impact pile driving and only in some pile driving scenarios, with the CPA ranging from 0.01 to 1 km, depending on species and pile/installation type (Tables 7.1.25 and 7.1.26). These distances are the "closest point of approach"; that is, based on animat modeling which factors in species-specific behavior (but not aversion from the noise source), an individual turtle needs to get at least that close to the pile for it to have accumulated enough acoustic energy to experience PTS. As explained above, these distances are close to or larger than the clearance and shutdown zone and we have determined that the clearance and shutdown procedures may not prevent all exposure of sea turtles to noise above the PTS threshold. The exposure analysis conducted by Limpert et al. (2024), as rounded to whole animals, predicts exposure of 5 leatherback and 2 loggerhead sea turtles to noise above the cumulative PTS threshold, inclusive of all foundation installation for both Project 1 and Project 2 (Tables 7.1.28 and 7.1.29). As the modeling does not incorporate aversion behavior the actual number of animals exposed to noise above the PTS threshold may be less; however, we have no way to reduce this estimate based on aversion behavior. Based on our consideration of the modeling and the density data, we consider this a reasonable estimate of the potential number of exposures that is based on the best available scientific information.

PTS is expected to consist of minor degradation of hearing capabilities occurring predominantly at the frequencies one-half to one octave above the frequency of the energy produced by pile driving (*i.e*., the low-frequency region below 2 kHz) (Cody and Johnstone, 1981; McFadden, 1986; Finneran, 2015), not severe hearing impairment. If hearing impairment occurs, it is expected that the affected animal would lose a few decibels in its hearing sensitivity; severe hearing impairment is not an expected outcome. Sea turtles do not vocalize and therefore do not rely on hearing for communication. Sea turtles may use acoustic cues such as waves crashing, wind, and vessel and/or predator noise to perceive the environment around them. Impacts on hearing sensitivity would be most likely to affect the ability to detect environmental cues; however, sea turtles are not known to rely heavily on sound for life functions (Nelms et al. 2016; Popper et al. 2014), and instead, may rely primarily on senses other than hearing for interacting with their environment, such as vision (Narazaki et al. 2013) and magnetic orientation (Avens and Lohmann 2003; Putman et al. 2015). As such, the likelihood that the loss of hearing in a sea turtle would impact its fitness (i.e., survival or reproduction) is low. NMFS defines "harm" in the definition of ESA "take" as "an act which actually kills or injures fish or wildlife (50 CFR 222.102). Such an act may include significant habitat modification or degradation where it actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding or sheltering" (50 CFR §222.102). The PTS anticipated is considered a minor but permanent auditory injury and, as it is an actual injury, is considered harm in the context of the ESA definition of take.

With this minor degree of PTS, we do not expect it to affect any of the affected individuals' overall health, reproductive capacity, or survival. The up to 5 leatherback and 2 loggerhead sea turtles that experience PTS could be less efficient at detecting environmental cues which could theoretically impact their ability to avoid predators or other threats, but that risk is considered low and we do not expect any delayed response related to a reduced ability to detect acoustic cues to result in any additional injury or any mortality. For this reason, we do not anticipate that the instances of PTS will result in any other injuries or any impacts on foraging or reproductive success, inclusive of mating and nesting, or survival of any of the sea turtles that experience PTS.

The exposure analysis also predicts exposure of sea turtles to noise expected to result in a behavioral response (Tables 7.1.28 and 7.1.29). It predicts the exposure of up to 2 Kemp's ridleys, 13 leatherbacks, 9 loggerheads, and 2 green sea turtles to noise above the behavioral impacts threshold. Neither SouthCoast nor BOEM modeled the number of sea turtles expected to be exposed to noise above the TTS threshold. It is reasonable to assume that at least some of the sea turtles exposed to noise above the 175 dB threshold but below the PTS threshold would also be exposed to noise above the cumulative TTS threshold. As we have no means of estimating the proportion of these turtles that would experience TTS, we have reasonably considered that all of these turtles may also experience TTS. Note that due to how we have considered exposure estimates that resulted in fractions of sea turtles, the numbers of exposures we expect are slightly higher than those presented in BOEM's BA. For example, BOEM rounded the predicted exposures of green and Kemp's ridley (0.1 each for Project 1 and 0.1 each for Project 2) to zero while we rounded up to one individual of each species for each Project.

Any sea turtles affected by TTS would experience a temporary, recoverable, hearing loss manifested as a threshold shift around the frequency of the pile driving noise. Because sea turtles do not use noise to communicate, any TTS would not impact communications. We expect that this temporary hearing impairment would affect frequencies utilized by sea turtles for acoustic cues such as the sound of waves, coastline noise, or the presence of a vessel or predator. Sea turtles are not known to depend heavily on acoustic cues for vital biological functions (Nelms et al. 2016; Popper et al. 2014), and instead, may rely primarily on senses other than hearing for interacting with their environment, such as vision (Narazaki et al. 2013) and magnetic orientation (Avens and Lohmann 2003; Putman et al. 2015). As such, it is unlikely that the temporary loss of hearing sensitivity in a sea turtle would affect its fitness (i.e., survival or reproduction). That said, it is possible that sea turtles use acoustic cues such as waves crashing, wind, vessel and/or predator noise to perceive the environment around them. If such cues increase survivorship (e.g., aid in avoiding predators, navigation), temporary loss of hearing sensitivity may have effects on individual sea turtle fitness. TTS of sea turtles is expected to only last for several days following the initial exposure (Moein et al. 1994). Given this short period of time, and that sea turtles are not known to rely heavily on acoustic cues, while TTS may impact the ability of affected individuals to avoid threats during the few days that TTS is experienced, we do not anticipate single TTSs would have any long-term impacts on the health or reproductive capacity or success of individual sea turtles; TTS is considered in the context of the ESA definition of harassment below.

Masking

Sea turtle hearing abilities and known use of sound to detect environmental cues is discussed above. Sea turtles are thought capable of detecting nearby broadband sounds, such as would be produced by pile driving. Thus, environmental sounds, such as the sounds of waves crashing along coastal beaches or other important cues for sea turtles, could possibly be masked for a short duration during pile driving. However, any masking would not persist beyond the period a sea turtle is exposed to pile driving noise (likely minutes but in no case exceeding the approximately 12 hours of pile driving that could occur in a single day). As addressed in Hazel et al. (2004), sea turtle reaction to vessels is thought to be based on visual cues and not sound; thus, we do not expect that any masking would increase the risk of vessel strike as sea turtles are not expected to rely on the noise of vessels to avoid vessels.

Behavioral Response and Stress

Based on prior observations of sea turtle reactions to sound, if a behavioral reaction were to occur, the responses could include increases in swim speed, change of position in the water column, or avoidance of the sound. The area where pile driving will occur is not known to be a breeding area and is over 600 km north of the nearest beach where sea turtle nesting has been documented (Virginia Beach, VA). Therefore, breeding adults and hatchlings are not expected in the area. The expected behavioral reactions would temporarily disrupt migration, feeding, or resting. However, that disruption will last for no longer than it takes the sea turtle to swim away from the area where noise is louder than 175 dB RMS (extending no more than 2.11 km from the pile being installed) and displacement from a particular area would last, at the longest, the duration of impact pile driving in a single day (up to 12 hours). There is no evidence to suggest that any avoidance or aversion would persist beyond the duration of the sound exposure. For migrating sea turtles, this avoidance or aversion is likely to result in a change in swimming direction. Resting sea turtles are expected to resume resting once they escape the noise. Foraging sea turtles are expected to resume foraging once suitable forage is located outside the area being avoided.

The Nantucket Shoals area is a high use area for leatherback sea turtles, particularly in the late summer and fall when leatherbacks forage on jellyfish (Rider et al. 2024, Dodge et al. 2014). Pile driving that occurs in the summer and fall for Project 1 has the potential to result in disruptions of leatherback foraging by temporarily displacing leatherbacks from the area surrounding a pile being driven; however, given the small area that a leatherback would be expected to avoid (up to approximately 2 km from the pile) and the limited period of disturbance (up to 12 hours) and that only a single, small area will be affected by project noise at a given time, effects on foraging leatherbacks are expected to be so small that they would not affect the health or energy budget of any individual.

Concurrent with the above responses, sea turtles are also expected to experience physiological stress responses. Stress is an adaptive response and does not normally place an animal at risk. Distress involves a chronic stress response resulting in a negative biological consequence to the individual. While all ESA-listed sea turtles that experience TTS and behavioral responses are also expected to experience a stress response, such responses are expected to be short-term in nature given the duration of pile driving (no more than 12 hours a day) and because we do not expect any sea turtles to be exposed to pile driving noise on more than one day. As such, we do not anticipate stress responses would be chronic, involve distress, or have negative long-term impacts on any individual sea turtle's fitness.

All behavioral responses to a disturbance, such as those described above, will have an energetic or metabolic consequence to the individual reacting to the disturbance (e.g., adjustments in migratory movements or disruption/delays in foraging or resting). Short-term interruptions of normal behavior are likely to have little effect on the overall health, reproduction, and energy balance of an individual or population (Richardson *et al.* 1995). As the disturbance will occur for a portion of each day for a period of up to 85 days in a single year (depending on the number of piles installed per day), with pile driving occurring for no more than 4 to 12 hours per day, this exposure and displacement will be temporary and not chronic. Therefore, any interruptions in behavior and associated metabolic or energetic consequences will similarly be temporary.

Here, we carry out the four-step assessment outlined in the NMFS Policy Directive regarding the ESA Term "Harass" (see additional information in the marine mammal section above) to determine if the effects to ESA listed sea turtles expected to be exposed to pile driving noise above the 175 dB threshold but below the acoustic injury threshold (PTS) meet the definition of ESA take by harassment. Use of the lease area by ESA listed sea turtles is well established in the warmer months when pile driving is planned. We establish above that up to 2 Kemp's ridley, 13 leatherback, 9 loggerhead, and 2 green sea turtles will be exposed to pile driving noise above the 175 dB threshold but below the acoustic injury threshold (PTS) (step 1).

For an individual, exposure to this annoyance will be limited to the duration of exposure to the pile driving noise, which would not exceed 12 hours (the maximum estimated period for pile driving in a single day). Given the small number of animals predicted to be exposed to pile driving noise, multiple exposures (i.e., exposure of a single animal to pile driving noise on multiple days) in a single construction season are not expected. Sea turtles in the lease area are expected to be migrating, foraging, or resting. Neither mating or nesting occur in areas where pile driving noise exposure will occur. Southern New England waters are seasonally important to sea turtles as they make migrations and feed. As noted above, the Nantucket Shoals area is a high use area for leatherback sea turtles, particularly in the late summer and fall when leatherbacks forage on jellyfish (Rider et al. 2024, Dodge et al. 2014). (step 2).

The expected response of the sea turtles exposed to pile driving noise is avoidance/aversion, which means we expect the individual to stop feeding or resting and move away from the noise source. For animals that are migrating, the response may be a change in direction or diversion of their course. Animals are likely to increase swimming speed and may change dive patterns. Individuals are expected to move far enough away from the pile being driven to be outside the area where noise is above the 175 dB threshold (traveling up to 2.2 km). As explained above, these individuals are expected to experience TTS (temporary hearing impairment) and masking (which, together with TTS would affect their ability to detect certain environmental cues). Sea turtles affected by TTS would experience a temporary, recoverable, hearing loss manifested as a threshold shift around the frequency of the pile driving noise. TTS of sea turtles is expected to only last for several days following the initial exposure (Moein et al. 1994). Because sea turtles do not use noise to communicate, any TTS would not impact communications. We expect that this temporary hearing impairment would affect frequencies utilized by sea turtles for acoustic cues such as the sound of waves, coastline noise, or the presence of a vessel or predator. Sea turtles are not known to depend heavily on acoustic cues for vital biological functions (Nelms et al. 2016; Popper et al. 2014), and instead, may rely primarily on senses other than hearing for interacting with their environment, such as vision (Narazaki et al. 2013) and magnetic orientation (Avens and Lohmann 2003; Putman et al. 2015). If sea turtles use acoustic cues such as waves crashing, wind, vessel and/or predator noise to perceive the environment around them, the temporary loss of hearing sensitivity would be expected to impact their behaviors during the time that TTS persists (up to several days). Masking would have similar impacts but duration would be limited to the period that the individual is exposed to pile driving noise (up to 12 hours). For the period that the animal is exposed to pile driving noise and likely the period that TTS persists, there will be a physiological stress response. Avoidance and aversion will have energetic consequences, as will any delay in foraging; however, as this will be limited to a short period (not exceeding 12 hours), the potential for impacts on an animal's overall energy budget or energetic reserves are limited. In summary, the expected response of sea turtles exposed to pile driving noise above the 175 dB threshold but below the injury threshold, are TTS, aversion/avoidance behavior, disruptions to resting, foraging and migrating, stress, and energetic consequences (step 3).

We have determined that the nature and duration or intensity of the expected response is a significant disruption of normal behavioral patterns (foraging, resting, migrating) that will be experienced for the several day period that TTS will persist. As a result of the energetic costs, evasive behaviors, and temporary impact on the ability to detect environmental cues which could affect the ability to avoid threats, TTS and behavioral disruption will create or increase the risk of injury for the affected sea turtles compared to those that are not exposed to pile driving noise (step 4). Therefore, based on this four-step analysis, we find that the 2 Kemp's ridley, 13 leatherback, 9 loggerhead, and 2 green sea turtles exposed to pile driving noise louder than 175 dB re 1uPa rms and experience TTS are likely to be adversely affected and that effect amounts to harassment as defined in the context of take under the ESA. As such, we expect the harassment of 2 Kemp's ridley, 13 leatherback, 9 loggerhead, and 2 green sea turtles as a result of exposure to pile driving noise.

We have determined that the effects identified here do not, however, meet the NMFS definition of "harm" in the ESA's definition of "take" (i.e., "an act which actually kills or injures fish or wildlife"). We do not expect that the individuals that experience this harassment would experience harm as we do not expect any actual injury to occur. The energetic consequences of the evasive behavior and delay in resting or foraging will be disruptive for the period of time that the individual is exposed to the noise source; however, the limited duration means that these consequences are not expected to affect any individual's ability to successfully obtain enough food to maintain their health, or impact the ability of any individual to make seasonal migrations or participate in breeding or nesting. Any impact of TTS and masking on the ability to detect environmental cues which could affect the ability to avoid threats, would make the animal more vulnerable but given the limited impact on hearing and that hearing is not thought to be a primary sense for detecting and avoiding threats such as vessel strikes, and that hearing will be fully recovered within a few days, we do not expect any actual injury to result (i.e., we do not expect TTS and behavioral disruption to result in vessel strike or entanglement). We do not expect any long term health effects that would affect an individual's ability to recover from other stressors or disease. We do not anticipate any impairment of the overall health, survivability, or reproduction of any individual sea turtle due to avoidance or displacement resulting from exposure to pile driving noise. TTS will resolve within no more than a week of exposure and is not expected to affect the health of any turtle or its ability to migrate, forage, breed, or nest. We also expect that there will not be such an increase in stress that there would be physiological consequences to the individual that could affect its health or ability to migrate, forage, breed, or nest. Thus, as no injury or mortality will actually occur, the response of individual sea turtles to pile driving noise does not meet the definition of "harm."

UXO/MEC Detonation

As explained above, no more than 10 detonations of UXO are included in the proposed action. No more than one detonation will occur in any 24-hour period. Mitigation for UXO detonations that is described in the BA and the proposed MMPA ITR and therefore considered part of the proposed action include seasonal restrictions (May 1 – November 30 only), a 500 m clearance zone for sea turtles, restricting detonations to daylight hours, and the use of a dual noise mitigation system (at least a double big bubble curtain) for all detonations to achieve 10 dB attenuation from modeled noise levels, and requirements to adjust/add noise attenuation if needed to not exceed modeled noise levels assuming 10 dB attenuation. Additionally, enough vessels with qualified PSOs would be deployed to provide 100% temporal and spatial coverage of the pre-clearance zones.

SouthCoast conducted modeling of acoustic fields for UXO detonations (Hannay and Zykov 2022 and Frankel et al. 2024[43]) at a variety of depths. Consistent with NMFS recommendations, Hannay and Zykov (2022) and Frankel et al. (2024) calculated ranges to distances where a sea turtle would be expected to experience auditory injury (PTS), non-auditory injury (gastrointestinal and lung injury), and mortality, based on the representative body mass of harbor seal pups as surrogates for sea turtles (see explanation of thresholds above). We have determined that given the size of leatherback sea turtles in the area, the harbor seal adult mass is the best representative while for the other species, the pup mass is appropriate. Table 7.1.40 presents the R95%-modeled distances (and area) to the relevant thresholds from a detonation of a 454 kg charge (the largest anticipated to occur) at the site/depth with the largest distance to thresholds and incorporation of the required 10dB attenuation, consistent with the results reported in Frankel el al. 2024.

Table 7.1.40 Maximum Distances (km) and Area (Km2) to Thresholds for Sea Turtles – E12 charge (454 kg) Mitigated (10 dB Attenuation), Maximum Distance for all modeled depths/locations

Injury Type	R95% distance (km)	R95% Area - (km^2)
Mortality - Impulse (1% exposed animals)	0.253 (adult proxy) 0.368 (calf/pup proxy)	0.2 km^2 0.43 km^2

[43] In October 2024, BOEM submitted an updated version of the Hannay and Zykov report which corrected an error in the calculation to the TTS SEL distance for UXO detonations for sea turtles. Those results are presented here.

Onset – Lung Injury - Impulse (onset of lung injury, 1% exposed animals)	0.452 (adult proxy) 0.694 (calf/pup proxy)	0.64 km^2 1.5 km^2
Onset Gastrointestinal Injury (1% of exposed animals)	0.125	0.05 km^2
PTS, peak (232 dB re 1uPa)	0.211	0.14 km^2
PTS SEL	0.555	0.97 km^2
TTS, peak (226 dB re 1uPa)	0.399	0.5 km^2
TTS SEL	2.690	22.73 km^2

source: Table 33, 34, 35, 40, in Hannay and Zykov 2022 and Tables 20-24 in Frankel et al. 2024

In the BA, BOEM concludes that exposure to UXO detonations that could result in any adverse effects to any individual sea turtles is extremely unlikely to occur. They base this conclusion on the small areas where noise above thresholds of concern would be experienced (in almost all cases less than 500 m), the low density of sea turtles in the area (fewer than 1 per 100 km^2), the small number of detonations (not to exceed 10), the short timer period when exposure could occur given the near-instantaneous noise/pressure associated with any blast, and the pre-clearance procedures which would delay any detonation if a sea turtle is observed within 500 m of any planned detonation.

We have used the distances presented above and the expected densities of sea turtles in the WDA (table 7.1.41) to calculate potential exposures; we multiplied the density by the area of water likely to be ensonified above the defined threshold levels (table 7.1.30). The result is then multiplied by 10 for the total number of detonations. The calculations used the largest ranges to thresholds for the maximum charge weight (E12; 1,000 pound [454 kg]) scenario presented in Hannay and Zykov 2022 and Frankel et al. 2024, with the required 10 dB attenuation.

Table 7.1.41 Estimated Densities of Sea Turtles within a 5 km buffer around the Lease Area (highest seasonal density)

Species	Maximum Seasonal Density (individuals/100 km^2)
Kemp's ridley	0.006
Leatherback	0.873
Loggerhead	0.206
Green	0.006

(adapted from BOEM BA Table 4.9-3); additional information on density sources is presented above.

Table 7.1.42 Total Number of ESA-Listed Sea Turtles Estimated to be Exposed to Sound Levels above Mortality, Injury (Auditory and Non-Auditory) and TTS thresholds for the Detonation of 10 UXOs – Mitigated (10 dB).

Species	PTS	TTS	Injury (slight lung injury)	Gastrointestinal Injury	Mortality (severe lung injury)
Green turtle	<0.001	<0.002	<0.001	<0.001	<0.001
Kemp's ridley	<0.001	<0.002	<0.001	<0.001	<0.001
Leatherback	0.05	0.23	0.018	0.004	0.06
Loggerhead	0.014	0.07	0.039	0.001	0.011

Considering all 10 UXO detonations, the modeling combined with the density estimates results in exposure estimate predictions that less than 0.05 or fewer sea turtles of each species would be exposed to noise that could result in mortality or any form of injury, including PTS (auditory injury) (Table 7.1.33). This exposure modeling did not incorporate consideration of any mitigation measures other than the 10 dB noise attenuation requirement. The clearance zone for sea turtles will extend 500 m from the site of the planned detonation. Given the small distances to the mortality and injury thresholds and the proposed measures to ensure the area within 500 m of the detonation is clear of sea turtles prior to detonation, this risk is even lower than the already very low exposure estimates, which are approaching zero even considering all 10 detonations. In consideration of the distances to thresholds, the very small (approaching zero) modeled exposure estimates, the 500 m clearance zone, and that detonations will be limited to daylight only and that the area will be monitored by multiple vessels with PSO coverage as necessary to ensure complete visibility of the pre-clearance area, we have determined that it is extremely unlikely that any sea turtles will be close enough to any of the 10 detonations to experience mortality or any injury, inclusive of PTS.

As reflected in table 7.1.42, using the modeled distances to the TTS thresholds and the density estimates, and considering all 10 detonations, modeling predicts that less than 0.01 green, less than 0.01 Kemp's ridley, 0.23 leatherback and 0.07 loggerhead sea turtles could be exposed to noise that could result in TTS. The distance to the TTS threshold (2.13 – 2.69 km, ER95%) exceeds the size of the clearance zone and is larger than the distance we would reasonably expect observers would be able to detect sea turtles. As such, and considering that exposure estimates of less than 0.1 are approaching zero and extremely unlikely to occur, we expect that no more than 1 leatherback would experience TTS as a result of exposure to noise from UXO detonations. Effects of TTS would be the same as those addressed for pile driving above; as such, we consider TTS as harassment in the context of the ESA definition of take. We note that this analysis is based on all 10 UXOs being 454-kg charges; as it is entirely unknown what size the UXOs that may need to be detonated (as a result of not being able to be avoided or relocated) will be, we consider it reasonable to base our analysis on consideration that all 10 UXOs are this large. In the event that the UXOs detonated are smaller, the distances to thresholds would be smaller (see Hannay and Zykov 2022); however, we note that considering TTS, detonation of three of the five charge sizes modeled would result in distances above the TTS threshold exceeding the 500 m clearance zone. We note that the conclusion reached here, that up to 1 leatherback sea turtle may be exposed to noise that could result in TTS is different than the conclusion reached by BOEM in their BA (i.e., that no sea turtles would be exposed to noise that could result in TTS); however, considering that the distance to the TTS threshold, we do not expect that the clearance protocols will prevent the exposure of all leatherbacks to the detonations.

Modeling was not carried out to estimate the number of sea turtles exposed to noise above the 175 dB behavioral threshold. However, given that the duration of the noise exposure will last only as long as the explosion (one second), we expect that any behavioral response would also be limited to that extremely short duration and as such, be a startle response. Any effects to sea turtles exposed to noise above the behavioral threshold but below the TTS threshold would be so small that they cannot be meaningfully measured, evaluated, or detected. As such, effects on behavior are insignificant.

Vessel Noise and Cable Installation

The vessels used for the proposed project will produce low-frequency, broadband underwater sound below 1 kHz (for larger vessels), and higher-frequency sound between 1 kHz to 50 kHz (for smaller vessels), although the exact level of sound produced varies by vessel type. Noise produced during cable installation is dominated by the vessel noise; therefore, we consider these together.

ESA-listed turtles could be exposed to a range of vessel noises within their hearing abilities. Depending on the context of exposure, potential responses of green, Kemp's ridley, leatherback, and loggerhead sea turtles to vessel noise disturbance, would include startle responses, avoidance, or other behavioral reactions, and physiological stress responses. Very little research exists on sea turtle responses to vessel noise disturbance. Currently, there is nothing in the available literature specifically aimed at studying and quantifying sea turtle response to vessel noise. However, a study examining vessel strike risk to green sea turtles suggested that sea turtles may habituate to vessel sound and may be more likely to respond to the sight of a vessel rather than the sound of a vessel, although both may play a role in prompting reactions (Hazel et al. 2007). Regardless of the specific stressor associated with vessels to which turtles are responding, they only appear to show responses (avoidance behavior) at approximately 10 m or closer (Hazel et al. 2007).

Therefore, the noise from vessels is not likely to affect sea turtles from further distances, and disturbance may only occur if a sea turtle hears a vessel nearby or sees it as it approaches. These responses appear limited to non-injurious, minor changes in behavior based on the limited information available on sea turtle response to vessel noise.

For these reasons, vessel noise is expected to cause minimal disturbance to sea turtles. If a sea turtle detects a vessel and avoids it or has a stress response from the noise disturbance, these responses are expected to be temporary and only endure while the vessel transits through the area where the sea turtle encountered it. Therefore, sea turtle responses to vessel noise disturbance are considered insignificant (i.e., so minor that the effect cannot be meaningfully evaluated), and a sea turtle would be expected to return to normal behaviors and stress levels shortly after the vessel passes by.

Operation of WTGs

As described above, many of the published measurements of underwater noise levels produced by operating WTGs are from older geared WTGs and may not be representative of newer direct-drive WTGs, like those that will be installed for the SouthCoast project. Elliot et al. (2019) reports underwater noise monitoring at the Block Island Wind Farm, which has direct-drive GE Haliade turbines. The loudest noise recorded was 126 dB re 1uPa at a distance of 50 m from the turbine when wind speeds exceeded 56 kmh. As noted above, based on wind speed records within the WDA (SouthCoast COP, Appendix X Table 7-1), wind speeds in the WDA exceed 55.6 kph (30 knots) less than 1% of the time; the 0-year mean wind speed at 10 m elevation is 7.2 m/s (26 kph or 14 kts). Elliot et al. (2019) conclude that based on monitoring of underwater noise at the Block Island site, under maximum potential impact scenarios, no risk of temporary or permanent hearing damage (PTS or TTS) for sea turtles could be projected even if an animal remained in the water at 50 m (164 ft.) from the turbine for a full 24-hour period. Similarly, in a review of data from 27 operational wind farms in the North Sea (turbines between 2.3 and 8 MW), the mean (broadband) total SPL (SPL50 or L50) at nominal power of the turbines varied between 112 and 131 dB (median and mean value 120 dB). HDR 2023 found that noise levels recorded during the 6 MW CVOW turbine operations ranged from 120 to 130 dB re 1 μPa except during storms, when the received levels increased to 145 dB re 1 μPa. Together, these publications are the best available data for estimating operational noise of the SouthCoast turbines. As underwater noise associated with the operation of the WTGs is below the thresholds for considering behavioral disturbance for sea turtles, and considering that there is no potential for exposure to noise above the peak or cumulative PTS or TTS thresholds, effects to sea turtles exposed to noise associated with the operating turbines are extremely unlikely to occur. No take of sea turtles from exposure to operational noise is expected.

HRG Surveys

Some of the equipment that is described by BOEM for use for HRG surveys produces underwater noise that can be perceived by sea turtles. This may include boomers, sparkers, and sub-bottom profilers. Extensive information on HRG survey noise and potential effects of exposure to sea turtles is provided in NMFS June 29, 2021 programmatic ESA consultation on certain geophysical and geotechnical survey activities (NMFS GAR 2021, Appendix C to this Opinion). We summarize the relevant conclusions here. For the equipment proposed for use by SouthCoast, the maximum distance to the 175 dB re 1uPa behavioral disturbance threshold is 90 meters; the TTS and PTS thresholds are not exceeded at any distance (see table 7.1.43).

Table 7.1.43 Largest PTS Exposure Distances from mobile HRG Sources at Speeds of 4.5 knots –Sea Turtles

HRG Source	Highest Source Level (dB re 1 µPa)	Sea Turtle Onset of Injury Threshold		Sea Turtle Behavior (175 dB re 1uPa rms)
		Peak	*SEL*	*RMS*
SBP: Boomers	176 dB SEL 207 dB RMS 216 PEAK	0	0	40
SBP: Sparkers	188 dB SEL 214 dB RMS 225 PEAK	0	0	90
Chirp Sub-Bottom Profilers	193 dB SEL 209 dB RMS 214 PEAK	0	0	2
Multi-beam echosounder (100 kHz)	185 dB SEL 224 dB RMS 228 PEAK	NA	NA	NA
Multi-beam echosounder (>200 kHz) (mobile, non-impulsive, intermittent)	182 dB SEL 218 dB RMS 223 PEAK	NA	NA	NA
Side-scan sonar (>200 kHz) (mobile, non-impulsive, intermittent)	184 dB SEL 220 dB RMS 226 PEAK	NA	NA	NA

Sea turtle PTS distances were calculated for 203 cSEL and 230 dB peak criteria from Navy (2017).
NA = not applicable due to the sound source being out of the hearing range for the group

None of the equipment being operated for these surveys that overlaps with the hearing range (30 Hz to 2 kHz) for sea turtles has source levels loud enough to result in PTS or TTS based on the peak or cumulative exposure criteria. Therefore, effects to hearing of any individual sea turtles exposed to HRG survey noise are extremely unlikely to occur.

As explained above, we expect that sea turtles would exhibit a behavioral response when exposed to received levels of 175 dB re: 1 µPa (rms) and are within their hearing range (below 2 kHz). The distance to this threshold is 40 m for boomers and is 90 m for sparkers and 2 m for chirps (Table 7.1.34). Thus, a sea turtle would need to be within 90 m of the HRG source to be exposed to potentially disturbing levels of noise. We expect that sea turtles would react to this exposure by swimming away from the sound source; this would limit exposure to a short time period, just the few seconds it would take an individual to swim away to avoid the noise. The risk of exposure to potentially disturbing levels of noise is reduced by the use of PSOs to monitor for sea turtles. A clearance zone (500 m in all directions) for ESA-listed species must be monitored around all vessels operating equipment at a frequency of less than 180 kHz. At the start of a survey, equipment cannot be turned on until the clearance zone is clear for at least 30 minutes. This condition is expected to reduce the potential for sea turtles to be exposed to noise that may be disturbing. However, even in the event that a sea turtle is submerged and not seen by the PSO, in the worst case, we expect that sea turtles would avoid the area ensonified by the survey equipment that they can perceive. Because the area where increased underwater noise will be experienced is transient and increased underwater noise will only be experienced in a particular area for less than two minutes, we expect any effects to behavior to be minor and limited to a temporary disruption of normal behaviors, temporary avoidance of the ensonified area and minor additional energy expenditure spent while swimming away from the noisy area. If foraging or migrations are disrupted, we expect that they will quickly resume once the survey vessel has left the area. No sea turtles will be displaced from a particular area for more than a few minutes. While the movements of individual sea turtles will be affected by the sound associated with the survey, these effects will be temporary (no more than two minutes) and localized (avoiding an area no larger than 90 m) and there will be only a minor and temporary impact on foraging, migrating, or resting sea turtles. For example, BOEM calculated that for a survey with equipment being towed at 3 knots, exposure of a sea turtle that was within 90 m of the source would last for less than two minutes.

Given the intermittent and short duration of exposure to any potentially disturbing noise from HRG equipment, effects to individual sea turtles from brief exposure to potentially disturbing levels of noise are expected to be minor and limited to a brief startle, short increase in swimming speed and/or short displacement from an area not exceeding 90 m in diameter, and will be so small that they cannot be meaningfully measured, detected, or evaluated; therefore, effects are insignificant, and take is not anticipated to occur.

7.1.5. Effects of Project Noise on Atlantic sturgeon

Background Information – Atlantic sturgeon and Noise

Impulsive sounds such as those produced by impact pile driving can affect fish in a variety of ways, and in certain circumstances, can cause mortality, auditory injury, barotrauma, and behavioral changes. Impulsive sound sources produce brief, broadband signals that are atonal transients (e.g., high amplitude, short-duration sound at the beginning of a waveform; not a continuous waveform). They are generally characterized by a rapid rise from ambient sound pressures to a maximal pressure followed by a rapid decay period that may include a period of diminishing, oscillating maximal and minimal pressures. For these reasons, they generally have an increased capacity to induce physical injuries in fishes, especially those with swim bladders

(Casper et al. 2013a; Halvorsen et al. 2012; Popper et al. 2014). These types of sound pressures cause the swim bladder in a fish to rapidly and repeatedly expand and contract, and pound against the internal organs. This pneumatic pounding may result in hemorrhage and rupture of blood vessels and internal organs, including the swim bladder, spleen, liver, and kidneys. External damage has also been documented, evident with loss of scales, hematomas in the eyes, base of fins, etc. (e.g., Casper et al. 2012c; Gisiner 1998; Halvorsen et al. 2012; Wiley et al. 1981; Yelverton et al. 1975a). Fish can survive and recover from some injuries, but in other cases, death can be instantaneous, occur within minutes after exposure, or occur several days later.

Hearing impairment
Research is limited on the effects of impulsive noise on the hearing of fishes, however some research on seismic air gun exposure has demonstrated mortality and potential damage to the lateral line cells in fish larvae, fry, and embryos after exposure to single shots from a seismic air gun near the source (0.01 to 6 m; Booman et al. 1996; Cox et al. 2012). Popper et al. (2005) examined the effects of a seismic air gun array on a fish with hearing specializations, the lake chub (*Couesius plumbeus*), and two species that lack notable hearing specializations, the northern pike (*Esox lucius*) and the broad whitefish (*Coregonus nasus*), a salmonid species. In this study, the average received exposure levels were a mean peak pressure level of 207 dB re 1 μPa; sound pressure level of 197 dB re 1 μPa; and single-shot sound exposure level of 177 dB re 1 μPa^2-s. The results showed temporary hearing loss for both lake chub and northern pike to both 5 and 20 air gun shots, but not for the broad whitefish. Hearing loss was approximately 20 to 25 dB at some frequencies for both the northern pike and lake chub, and full recovery of hearing took place within 18-24 hours after sound exposure. Examination of the sensory surfaces showed no damage to sensory hair cells in any of the fish from these exposures (Song et al. 2008). Popper et al. (2006) also indicated exposure of adult fish to a single shot from an air gun array (consisting of four air guns) within close range (six meters) did not result in any signs of mortality, seven days post-exposure. Although non-lethal injuries were observed, the researchers could not attribute them to air gun exposure as similar injuries were observed in controlled fishes. Other studies conducted on fishes with swim bladders did not show any mortality or evidence of other injury (Hastings et al. 2008; McCauley and Kent 2012; Popper et al. 2014; Popper et al. 2007; Popper et al. 2005).

McCauley et al. (2003) showed loss of a small percent of sensory hair cells in the inner ear of the pink snapper (*Pagrus auratus*) exposed to a moving air gun array for 1.5 hours. Maximum received levels exceeded 180 dB re 1 μPa^2-s for a few shots. The loss of sensory hair cells continued to increase for up to at least 58 days post-exposure to 2.7 percent of the total cells. It is not known if this hair cell loss would result in hearing loss since TTS was not examined. Therefore, it remains unclear why McCauley et al. (2003) found damage to sensory hair cells while Popper et al. (2005) did not. However, there are many differences between the studies, including species, precise sound source, and spectrum of the sound that make it difficult to speculate what caused hair cell damage in one study and not the other.

Hastings et al. (2008) exposed the pinecone soldierfish (*Myripristis murdjan*), a fish with anatomical specializations to enhance their hearing and three species without notable specializations: the blue green damselfish (*Chromis viridis*), the saber squirrelfish (*Sargocentron* *spiniferum*), and the bluestripe seaperch (*Lutjanus kasmira*) to an air gun array. Fish in cages in 16 ft. (4.9 m) of water were exposed to multiple air gun shots with a cumulative sound exposure level of 190 dB re 1 μPa^2-s. The authors found no hearing loss in any fish following exposures. Based on the tests to date that indicated TTS in fishes from exposure to impulsive sound sources (air guns and pile driving) the recommended threshold for the onset of TTS in fishes is 186 dB SEL_{cum} re 1 μPa^2-s, as described in the 2014 *ANSI Guidelines*.

Physiological Stress

Physiological effects to fishes from exposure to anthropogenic sound are increases in stress hormones or changes to other biochemical stress indicators (e.g., D'amelio et al. 1999; Sverdrup et al. 1994; Wysocki et al. 2006). Fishes may have physiological stress reactions to sounds that they can detect. For example, a sudden increase in sound pressure level or an increase in overall background noise levels can increase hormone levels and alter other metabolic rates indicative of a stress response. Studies have demonstrated elevated hormones such as cortisol, or increased ventilation and oxygen consumption (Hastings and C. 2009; Pickering 1981; Simpson et al. 2015; Simpson et al. 2016; Smith et al. 2004a; Smith et al. 2004b). Although results from these studies have varied, it has been shown that chronic or long-term (days or weeks) exposures of continuous anthropogenic sounds can lead to a reduction in embryo viability (Sierra-Flores et al. 2015) and decreased growth rates (Nedelec et al. 2015).

Generally, stress responses are more likely to occur in the presence of potentially threatening sound sources such as predator vocalizations or the sudden onset of loud and impulsive sound signals. Stress responses are typically considered brief (a few seconds to minutes) if the exposure is short or if fishes habituate or have previous experience with the sound**.** However, exposure to chronic noise sources may lead to more severe effects leading to fitness consequences such as reduced growth rates, decreased survival rates, reduced foraging success, etc. Although physiological stress responses may not be detectable on fishes during sound exposures, NMFS expects a stress response occurs when other physiological impacts such as injury or hearing loss occur.

Some studies have been conducted that measure changes in cortisol levels in response to sound sources. Cortisol levels have been measured in fishes exposed to vessel noises, predator vocalizations, or other tones during playback experiments**.** Nichols et al. (2015a) exposed giant kelpfish (*Heterostichus rostratus*) to vessel playback sounds, and fish increased levels of cortisol were found with increased sound levels and intermittency of the playbacks. Sierra-Flores et al. (2015) demonstrated increased cortisol levels in fishes exposed to a short duration upsweep (a tone that sweeps upward across multiple frequencies) across 100 to 1,000 Hz. The levels returned to normal within one hour post-exposure, which supports the general assumption that spikes in stress hormones generally return to normal once the sound of concern ceases**.** Gulf toadfish (*Opsanus beta*) were found to have elevated cortisol levels when exposed to low-frequency dolphin vocalization playbacks (Remage-Healey et al. 2006). Interestingly, the researchers observed none of these effects in toadfish exposed to low frequency snapping shrimp "pops," indicating what sound the fish may detect and perceive as threats. Not all research has indicated stress responses resulting in increased hormone levels. Goldfish exposed to continuous (0.1 to 10 kHz) sound at a pressure level of 170 dB re 1 µPa for one month showed no increase in stress hormones (Smith et al. 2004b). Similarly, Wysocki et al. (2007b) exposed rainbow trout to continuous band-limited noise with a sound pressure level of about 150 dB re 1 µPa for nine months with no observed stress effects. Additionally, the researchers found no significant changes to growth rates or immune systems compared to control animals held at a sound pressure level of 110 dB re 1 µPa.

Masking

As described previously in this biological opinion, masking generally results from a sound impeding an animal's ability to hear other sounds of interest. The frequency of the received level and duration of the sound exposure determine the potential degree of auditory masking. Similar to hearing loss, the greater the degree of masking, the smaller the area becomes within which an animal can detect biologically relevant sounds such as those required to attract mates, avoid predators or find prey (Slabbekoorn et al. 2010). Because the ability to detect and process sound may be important for fish survival, anything that may significantly prevent or affect the ability of fish to detect, process or otherwise recognize a biologically or ecologically relevant sound could decrease chances of survival. For example, some studies on anthropogenic sound effects on fishes have shown that the temporal pattern of fish vocalizations (e.g., sciaenids and gobies) may be altered when fish are exposed to sound-masking (Parsons et al. 2009). This may indicate fish are able to react to noisy environments by exploiting "quiet windows" (e.g., Lugli and Fine 2003) or moving from affected areas and congregating in areas less disturbed by nuisance sound sources. In some cases, vocal compensations occur, such as increases in the number of individuals vocalizing in the area, or increases in the pulse/sound rates produced (Picciulin et al. 2012). Fish vocal compensations could have an energetic cost to the individual, which may lead to a fitness consequence such as affecting their reproductive success or increase detection by predators (Amorin et al. 2002; Bonacito et al. 2001).

Behavioral Responses

In general, NMFS expects that most fish species would respond in similar manner to both air guns and impact pile driving. As with explosives, these reactions could include startle or alarm responses, quick bursts in swimming speeds, diving, or changes in swimming orientation. In other responses, fish may move from the area or stay and try to hide if they perceive the sound as a potential threat. Other potential changes include reduced predator awareness and reduced feeding effort. The potential for adverse behavioral effects will depend on a number of factors, including the sensitivity to sound, the type and duration of the sound, as well as life stages of fish that are present in the areas affected.

Fish that detect an impulsive sound may respond in "alarm" detected by Fewtrell (2003), or other startle responses may also be exhibited. The startle response in fishes is a quick burst of swimming that may be involved in avoidance of predators. A fish that exhibits a startle response may not necessarily be injured, but it is exhibiting behavior that suggests it perceives a stimulus indicating potential danger in its immediate environment. However, fish do not exhibit a startle response every time they experience a strong hydroacoustic stimulus. A study in Puget Sound, Washington suggests that pile driving operations disrupt juvenile salmon behavior (Feist et al. 1992). Though no underwater sound measurements are available from that study, comparisons between juvenile salmon schooling behavior in areas subjected to pile driving/construction and other areas where there was no pile driving/construction indicate that there were fewer schools of fish in the pile-driving areas than in the non-pile driving areas. The results are not conclusive but there is a suggestion that pile-driving operations may result in a disruption in the normal migratory behavior of the salmon in that study, though the mechanisms salmon may use for avoiding the area are not understood at this time.

Because of the inherent difficulties with conducting fish behavioral studies in the wild, data on behavioral responses for fishes is largely limited to caged or confined fish studies, mostly limited to studies using caged fishes and the use of seismic air guns (Lokkeborg et al. 2012). In an effort to assess potential fish responses to anthropogenic sound, NMFS has historically applied an interim criteria for onset injury of fish from impact pile driving which was agreed to in 2008 by a coalition of federal and non-federal agencies along the West Coast (FHWG 2008). These criteria were also discussed in Stadler and Woodbury (2009), wherein the onset of physical injury for fishes would be expected if either the peak sound pressure level exceeds 206 dB (re 1 μPa), or the SEL_{cum}, (re 1 μPa^2-s) accumulated over all pile strikes occurring within a single day, exceeds 187 dB SEL_{cum} (re 1 μPa^2-s) for fish two grams or larger, or 183 dB re 1 μPa^2-s for fishes less than two grams. The more recent recommendations from the studies conducted by Halvorsen et al. (2011), Halvorsen et al. (2012), and Casper et al. (2012c), and summarized in the 2014 *ANSI Guidelines* are similar to these levels, but also establishes levels based upon fish hearing abilities, the presence of a swim bladder as well as severity of effects ranging from mortality, recoverable injury to TTS. The interim criteria developed in 2008 were developed primarily from air gun and explosive effects on fishes (and some pile driving) because limited information regarding impact pile driving effects on fishes was available at the time.

7.1.5.1. Criteria Used for Assessing Effects of Noise Exposure to Atlantic Sturgeon

There is no available information on the hearing capabilities of Atlantic sturgeon specifically, although the hearing of two other species of sturgeon have been studied. While sturgeon have swimbladders, they are not known to be used for hearing, and thus sturgeon appear to only rely directly on their ears for hearing. Popper (2005) reported that studies measuring responses of the ear of European sturgeon (*Acipenser sturio*) using physiological methods suggest sturgeon are likely capable of detecting sounds from below 100 Hz to about 1 kHz, indicating that sturgeon should be able to localize or determine the direction of origin of sound. Meyer and Popper (2002) recorded auditory evoked potentials of varying frequencies and intensities for lake sturgeon (*Acipenser fulvescens*) and found that lake sturgeon can detect pure tones from 100 Hz to 2 kHz, with best hearing sensitivity from 100 to 400 Hz. They also compared these sturgeon data with comparable data for oscar (*Astronotus ocellatus*) and goldfish (*Carassius auratus*) and reported that the auditory brainstem responses for the lake sturgeon were more similar to goldfish (that can hear up to 5 kHz) than to the oscar (that can only detect sound up to 400 Hz); these authors, however, felt additional data were necessary before lake sturgeon could be considered specialized for hearing (Meyer and Popper 2002). Lovell et al. (2005) also studied sound reception and the hearing abilities of paddlefish (*Polyodon spathula*) and lake sturgeon. Using a combination of morphological and physiological techniques, they determined that paddlefish and lake sturgeon were responsive to sounds ranging in frequency from 100 to 500 Hz, with the lowest hearing thresholds from frequencies in a bandwidth of between 200 and 300 Hz and higher thresholds at 100 and 500 Hz; lake sturgeon were not sensitive to sound pressure. We assume that the hearing sensitivities reported for these other species of sturgeon are representative of the hearing sensitivities of all Atlantic sturgeon DPSs.

The Fisheries Hydroacoustic Working Group (FHWG) was formed in 2004 and consists of biologists from NMFS, USFWS, FHWA, USACE, and the California, Washington and Oregon DOTs, supported by national experts on underwater sound producing activities that affect fish and wildlife species of concern. In June 2008, the agencies signed an MOA documenting criteria for assessing physiological effects of impact pile driving on fish. The criteria were developed for the acoustic levels at which physiological effects to fish could be expected. It should be noted that these criteria are for the onset of physiological effects (Stadler and Woodbury, 2009), not levels at which fish are necessarily mortally damaged. These criteria were developed to apply to all fish species, including listed green sturgeon, which are biologically similar to shortnose and Atlantic sturgeon and for these purposes can be considered a surrogate. The interim criteria are:

- Peak SPL: 206 dB re 1 µPa
- SELcum: 187 dB re 1µPa^2-s for fishes 2 grams or larger (0.07 ounces).
- SELcum: 183 dB re 1µPa^2-s for fishes less than 2 grams (0.07 ounces).

At this time, these criteria represent the best available information on the thresholds at which physiological effects to sturgeon are likely to occur. It is important to note that physiological effects may range from minor injuries from which individuals are anticipated to completely recover with no impact to fitness to significant injuries that will lead to death. The severity of injury is related to the distance from the pile being installed and the duration of exposure. The closer to the source and the greater the duration of the exposure, the higher likelihood of significant injury.

Popper et al. (2014) presents a series of proposed thresholds for onset of mortality and potential injury, recoverable injury, and temporary threshold shift for fish species exposed to pile driving noise. This assessment incorporates information from lake sturgeon and includes a category for fish that have a swim bladder that is not involved in hearing (such as Atlantic sturgeon). The criteria included in Popper et al. (2014) are:

- Mortality and potential mortal injury: 210 dB SELcum or >207 dB peak
- Recoverable injury: 203 dB SELcum or >207 dB peak
- TTS: >186 dB SELcum.

While these criteria are not exactly the same as the FHWG criteria, they are very similar. Based on the available information, for the purposes of this Opinion, we consider the potential for physiological effects upon exposure to 206 dB re 1 µPa peak and 187 dB re 1 µPa^2-s cSEL. Use of the 183 dB re 1 µPa^2-s cSEL threshold is not appropriate for this consultation because all sturgeon in the action area will be larger than 2 grams. Physiological effects could range from minor injuries that a fish is expected to completely recover from with no impairment to survival to major injuries that increase the potential for mortality, or result in death.

NMFS has adopted thresholds described in FHWG 2008 and Popper et al. 2014 for the anticipated onset of mortality and physical injury resulting from exposure to underwater explosives. These thresholds are:

- onset of mortality (received level): $L_{p,\text{0-pk,flat}}$: 229 dB
- onset of physical injury (received level): $L_{p,\text{0-pk,flat}}$: 206 dB; $L_{\text{E},p,,\text{12h}}$: 187 dB (fish 2 grams or greater); $L_{\text{E},p,,\text{12h}}$: 183 dB (fish less than 2 g)

We use 150 dB re: 1 μPa RMS as a threshold for examining the potential for behavioral responses by individual listed fish to noise with frequency less than 1 kHz. This is supported by information provided in a number of studies described above (Andersson et al. 2007, Purser and Radford 2011, Wysocki et al. 2007). Responses to temporary exposure of noise of this level is expected to be a range of responses indicating that a fish detects the sound, these can be brief startle responses or, in the worst case, we expect that listed fish would completely avoid the area ensonified above 150 dB re: 1 uPa rms. Popper et al. (2014) does not identify a behavioral threshold but notes that the potential for behavioral disturbance decreases with the distance from the source.

7.1.5.2 Effects of Project Noise on Atlantic sturgeon

Foundation Pile Driving

Acoustic propagation modeling of impact pile driving of monopiles (16 m diameter) and jacket (4.5 m pin piles, pre- and post-piled) was carried out to determine distances to injury and behavioral disturbance thresholds for fish using summer and winter propagation and two locations within the lease area (Limpert et al. 2024; Tables 50-55). The acoustic ranges ($R_{95\%}$) to fish impact criteria thresholds (i.e., onset of injury and behavioral disturbance) were calculated by determining the isopleth at which thresholds could be exceeded considering 10dB attenuation; as requirements for achieving 10 dB attenuation are part of the proposed action, those results are presented here and form the basis for our effects analysis. For the sound exposure level (SEL, cumulative exposure) criteria, acoustic energy was accumulated for all pile driving strikes in a 24-hour period. The distances from the pile where noise will be elevated above the identified thresholds are presented in table 7.1.44 below.

Table 7.1.44. Acoustic ranges ($R_{95\%}$ in km) to acoustic thresholds for Atlantic sturgeon for 16 m monopiles, and 4.5 m pin piles (pre and post piled, 4 piles/day). Greatest distance for the two modeled locations. Summer and Winter sound profile

Threshold		**4.5 m pin pile (post-piled jacket, 3500 kJ hammer) – OSP foundation**		**4.5 m pin pile (pre-piled jacket, 3500 kJ hammer) – WTG foundation**		**16 m monopile (6600 kJ hammer)**	
		Summer	winter	Summer	Winter	Summer	winter
Physiological Effects/Injury	peak (206)	0.10	0.10	0.08	0.08	0.15	0.16
	Cumulative (24 hr) 187	7.34	8.21	6.31	6.83	8.50	9.68
Behavior	150 dB re 1uPa rms	10.99	13.02	9.28	10.79	13.86	17.22

Source: Tables 50-55 in Limpert et al. 2024; the greatest distance modeled at the two representative locations is presented here.

Modeling to determine distances to injury and behavioral disturbance thresholds for fish during vibratory pile setting of monopiles or pin piles was not carried out. During the consultation period, BOEM explained that this was because injury is not an expected outcome of exposure by Atlantic sturgeon to vibratory pile driving and because the distances to the behavioral disturbance thresholds would be shorter during vibratory pile driving than during impact pile driving; as no piles will be installed with just vibratory pile driving, the impact pile driving model results were representative of the maximum expected noise exposure for a sturgeon on a given pile driving day. We agree that the best available information supports this determination.

No density estimates for Atlantic sturgeon are available for the action area or for any area that could be used to estimate density in the action area. Therefore, it was not possible to conduct an exposure analysis to predict the number of Atlantic sturgeon likely to be exposed to any of the thresholds identified here.

Consideration of Mitigation Measures
Here, we consider the measures that are part of the proposed action, either because they are proposed by SouthCoast or by BOEM and reflected in the proposed action as described to us by BOEM in the BA, or are included in the conditions of the proposed MMPA ITA (recognizing that the MMPA conditions are related to marine mammals only but may provide some benefit to other species). Specifically, we consider how those measures may avoid or minimize exposure of Atlantic sturgeon to pile driving noise. Details of these proposed measures are included in Section 3.0 *Description of the Proposed Action* and the Appendixes.

Atlantic sturgeon are not visible to PSOs because they occur near the bottom, and depths in the areas where pile driving is planned would preclude visual observation of fish near the bottom. Therefore, monitoring of clearance zones or areas beyond the clearance zones will not minimize exposure of Atlantic sturgeon to pile driving noise. Because Atlantic sturgeon do not vocalize, PAM cannot be used to monitor Atlantic sturgeon presence; therefore, the use of PAM will not reduce exposure of Atlantic sturgeon to pile driving noise.

No pile driving would occur between January 1 and May 15 in any part of the lease and would not occur between October 16 and May 31 in the NARW EMA to avoid the time of year with the highest densities of right whales in the project area. Information from Ingram et al. (2019) indicates that abundance of Atlantic sturgeon in the New York Wind Energy Area peaked from November through January. If seasonal patterns are similar in the SouthCoast WDA, the seasonal restriction on pile driving would reduce the number of Atlantic sturgeon that would otherwise have been exposed to foundation pile driving noise; however, absent a similar study in the SouthCoast lease area, it is not possible to determine if there would be any reduction in exposure compared to the exposure that would occur absent these time of year restrictions. We do not have enough information on the density or seasonal distribution of Atlantic sturgeon in the action area encompassing the WDA to determine how these seasonal restrictions may or may not reduce the exposure of Atlantic sturgeon to pile driving noise.

For all foundation pile driving, SouthCoast would implement sound attenuation technology that would target at least a 10 dB reduction in noise, and that must achieve in-field measurements no greater than those modeled and presented in the BA with 10 dB attenuation (see Table 7.1.35 above). The attainment of a 10 dB reduction in impact pile driving was incorporated into the estimates of the area where injury or behavioral disruption may occur as presented above. If a reduction greater than 10 dB is achieved, the size of the area of impact would be smaller which would likely result in a smaller number of Atlantic sturgeon exposed to pile driving noise.

Soft start procedures can provide a warning to animals or provide them with a chance to leave the area prior to the hammer operating at full capacity. As described above, for impact pile driving before full energy pile driving begins, pile driving will occur at a reduced hammer energy for a minimum of 20 minutes. Even at full hammer energy, a sturgeon would need to be within 80 to 160 m of the pile being installed to be exposed to be exposed to noise above the 206 dB re 1uPa threshold (see Table 7.1.35 above); a sturgeon would need to be even closer during the soft-start period when the hammer is operating at reduced energy. Given the dispersed nature of Atlantic sturgeon in the lease area and the deployment of the double bubble curtain (which is expected to extend to approximately 150 m from the pile), this co-occurrence is extremely unlikely to occur. We expect that any Atlantic sturgeon close enough to the pile to be exposed to noise above 150 dB re 1uPa rms would experience behavioral disturbance as a result of the soft start and that these sturgeon would exhibit evasive behaviors and swim away from the noise source. During the soft start period, noise will be above 150 dB at a distance of several kilometers from the pile being driven. The use of the soft start is expected to give Atlantic sturgeon near enough to the piles to be exposed to the soft start noise a "head start" on escape or avoidance behavior by causing them to swim away from the source. It is possible that some Atlantic sturgeon would swim out of the noisy area before full energy pile driving begins; in this case, the number of Atlantic sturgeon exposed to noise that may result in injury would be reduced. It is likely that by eliciting avoidance behavior prior to full power pile driving, the soft start will reduce the duration of exposure to noise that could result in behavioral disturbance. However, we are not able to predict the extent to which the soft start will reduce the extent of exposure above the 150 dB re 1uPa threshold for considering behavioral impacts.

As described above, SouthCoast will also conduct thorough hydroacoustic monitoring for a subset of impact-driven piles. The required sound source verification will provide information necessary to confirm that the sound source characteristics predicted by the modeling are reflective of actual sound source characteristics in the field. If noise levels are higher than predicted by the modeling described here, additional noise attenuation measures will be implemented to reduce distances to the injury and behavioral disturbance thresholds. In the event that noise attenuation measures and/or adjustments to pile driving cannot reduce the distances to less than those modeled, this may be considered new information that reveals effects of the action that may affect listed species in a manner or to an extent not previously considered and reinitiation of this consultation may be necessary.

Exposure of Atlantic sturgeon to Noise above the Onset of Injury Threshold during Pile Driving for Foundation Installation

As described in the *Environmental Baseline* section of this Opinion, the WDA has not been systematically surveyed for Atlantic sturgeon; however, based on the best available information on the distribution of Atlantic sturgeon in the marine environment, we expect Atlantic sturgeon to occur at least occasionally in the portion of the action area encompassing the WDA where they could be exposed to pile driving noise. Given the area in which pile driving noise will occur is offshore and outside of any known aggregation areas, we expect its use by Atlantic sturgeon will be intermittent and limited to transient individuals moving through it that may be foraging opportunistically in areas where benthic invertebrates are present. The area is not known to be a preferred foraging area and has not been identified as an aggregation area. This intermittent, transient presence of individuals is consistent with tagging and tracking studies of Atlantic sturgeon in other marine areas (Ingram et al. 2019, Rothermel et al. 2020) where residence was detected for short durations (less than 2 hours to less than 2 days in the same area).

Given the characteristics of sound produced during vibratory pile installation and the lack of observations of physical injury on fish from vibratory underwater sound pressure levels, NMFS does not consider there to be a risk of injury to Atlantic sturgeon due to exposure to vibratory pile driving noise. As such, it is extremely unlikely that any Atlantic sturgeon would experience injury due to exposure to noise generated during vibratory pile setting.

Acoustic range modeling (Table 7.1.35) indicates that in order to be exposed to pile driving noise that could result in injury, an Atlantic sturgeon would need to be within 160 m of a monopile, or 80 m of a pin pile for a single strike of the impact hammer (based on the 206 dB peak threshold). Given the dispersed distribution of Atlantic sturgeon in and near the WDA, the potential for co-occurrence in time and space is extremely unlikely given the small area where exposure to peak noise could occur (extending up to approximately 160 m from the pile). We also expect that the bubble curtain(s) deployed as part of the noise attenuation system will extend to approximately 150 m from the pile, this is likely to further deter Atlantic sturgeon from being closer than that to the pile. This risk is further reduced by the intermittent nature of the pile driving, with impact pile driving occurring for up to 4 hours at a time or up to 12 hours a day, which limits the potential opportunities for co-occurrence. The soft-start, which we expect would result in a behavioral reaction and movement outside the area with the potential for exposure to the peak injury threshold, reduces this risk even further. As described above, during the soft start, an Atlantic sturgeon would need to be even closer to the pile being driven to be exposed to peak noise that could result in physiological effects. Given these considerations, we do not anticipate any Atlantic sturgeon will be exposed to noise above the peak injury threshold during any pile driving for foundation installation.

Considering the 187 dB SELcum threshold (see Table 7.1.35) and the potential to be exposed to pile driving noise long enough to result in injury, an Atlantic sturgeon would need to remain within 9.28 to 17.22 km of all piles being installed in a 24-hour period in order to accumulate enough noise exposure to experience physiological effects/onset of injury. Considering the anticipated behavioral reaction of sturgeon to avoid pile driving noise above 150 dB re 1 uPa RMS (which will extend beyond that distance where injury could occur) and the swimming abilities of Atlantic sturgeon, this is extremely unlikely to occur. Downie and Kieffer (2017) reviewed available information on maximum sustained swimming ability (Ucrit) for a number of sturgeon species. No information was presented on Atlantic sturgeon. Kieffer and May (2020) report that swimming speed of sturgeons is consistent at approximately 2 body lengths/second. Recent work evaluating swim performance of adult shortnose sturgeon in an experimental flume setting suggests that sturgeon swim speed may be even greater than previously considered (Castro-Santos et al. 2024). Considering that the smallest Atlantic sturgeon in the ocean environment where piles will be driven will be migratory subadults (at least 75 cm length), we can assume a minimum swim speed of 150 cm/second (equivalent to 5.4 km/hour) for Atlantic sturgeon in the WDA. Assuming a straight line escape and the slowest anticipated swim speed (5.4 km/h), even a sturgeon that was close by the pile at the start of pile driving would be able to swim away from the noisy area well before being exposed to the noise for a long enough period to meet the 187 dB SELcum threshold. The distance we would expect a sturgeon to cover in the up to 4 hours it would take to install a monopile is 21.6 km, in the 2.2 hours it would take to drive a single pin pile, a sturgeon could swim at least 10.2 km. We expect that the soft-start will mean that the closest a sturgeon is to the pile being driven at the start of full power driving is several hundred meters away which further reduces the duration of exposure to noise that could accumulate to exceed the 187 dB SELcum threshold. Given these considerations, we expect any Atlantic sturgeon that are exposed to pile driving noise will be able to avoid exposure to noise above the levels that could result in exposure to the cumulative injury threshold. Based on this analysis and consideration of the peak and cumulative noise thresholds for injury, it is extremely unlikely that any Atlantic sturgeon will be exposed to noise that will result in injury. Therefore, no take by harm (i.e., injury) of any Atlantic sturgeon is expected to occur.

Effects of Noise Exposure above 150 dB re 1uPa rms but below the injury threshold
We expect Atlantic sturgeon to exhibit a behavioral response upon exposure to noise louder than 150 dB re 1uPa RMS but below the injury threshold. This response could range from a startle with immediate resumption of normal behaviors to complete avoidance of the area. As established above, the area where pile driving will occur is not a high use area for Atlantic sturgeon and use is limited to transient individuals using the area for migration, with opportunistic foraging expected to occur where suitable benthic resources are present. The area is not an aggregation area, and sustained foraging is not known to occur in this area.

During active pile driving, the area that will have underwater noise above the 150 dB re 1uPa RMS threshold will extend approximately 9.3 to 17.3 km from the pile being installed for a period of up to 12 hours per day (see Tables 7.1.35). We expect that Atlantic sturgeon exposed to noise above 150 dB re 1uPa RMS would exhibit a behavioral response and may temporarily avoid the entire area where noise is louder than 150 dB re 1uPa RMS. The consequences for an individual sturgeon would be alteration of movements to avoid the noise and temporary cessation of opportunistic foraging. Considering the minimum swimming speeds noted above, we expect a sturgeon actively avoiding this area could swim out of it in 2 to 3 hours.

While in some instances temporary displacement from an area may have significant consequences to individuals or populations, this is not the case here. For example, if individual Atlantic sturgeon were prevented or delayed from accessing spawning habitat or were precluded from a foraging area for an extensive period, there could be impacts to reproduction and the health of individuals, respectively. However, as explained above, the area where noise may be at disturbing levels is used only for movement between other more highly used portions of the coastal Atlantic Ocean and is used only for opportunistic, occasional foraging; avoidance of any area ensonified during impact pile driving for the WTG or OSP foundations would not block or delay movement to spawning, foraging, or other important habitats.

All behavioral responses to a disturbance, such as those described above, will have an energetic or metabolic consequence to the individual reacting to the disturbance (e.g., adjustments in migratory movements or disruption in opportunistic foraging). Short-term interruptions of normal behavior are likely to have little effect on the overall health, reproduction, and energy balance of an individual or population (Richardson *et al.* 1995). As the disturbance will occur for a portion of each day for a period of no more than 85 days in a given year (depending on how many piles are installed per day), with pile driving occurring for no more than 12 non-continuous hours per day during that period, this exposure and displacement will be temporary and intermittent and not chronic. Therefore, any interruptions in behavior and associated metabolic or energetic consequences will similarly be temporary. Thus, we do not anticipate any impairment of the health, survivability, or reproduction of any individual Atlantic sturgeon.

As explained above, NMFS Interim Guidance defines harassment as to "[c]reate the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering." Here, we consider whether the effects to Atlantic sturgeon resulting from exposure to pile driving noise meet the ESA definition of harassment. We have established that some Atlantic sturgeon are likely to be exposed to the stressor or disturbance (in this case, pile driving noise above 150 dB re 1uPa rms). This disturbance is expected to be intermittent and limited in time and space as it will only occur when active pile driving is occurring and only in the geographic area where noise is above the behavioral disturbance threshold. As explained above, the expected response of any Atlantic sturgeon exposed to disturbing levels of noise, are expected to be alterations to their movements and swimming away from the source of the noise. This means they will need to alter their migration route; foraging would also be disrupted during this period. This will result in minor, temporary energetic costs that are expected to be fully recoverable. The nature, duration, and intensity of the response will not be a significant disruption of any behavior patterns. This is because any alterations of the movements of an individual sturgeon to avoid pile driving noise will be a minor disruption of migration, potentially taking it off of its normal migratory path for a few hours but not disrupting its overall migration (e.g., it will not result in delays or other impacts that would have a consequence to the individual). Similarly, any disruption of foraging will be temporary and limited to the few hours that the sturgeon is moving away from the noise. As the area where these impacts will occur is an area where only occasional, opportunistic foraging will occur, this will not be a significant disruption to foraging behavior. Based on this analysis, the nature and duration of the response to exposure to pile driving noise above the behavioral disturbance threshold is not a significant disruption of behavior patterns; therefore, no take by harassment is anticipated. Based on this analysis we have similarly determined that it is extremely unlikely that any Atlantic sturgeon will be exposed to noise which actually kills or injures any individual; thus no take by harm is anticipated.

We have also considered if the avoidance of the area where pile driving noise will be experienced would increase the risk of vessel strike or entanglement in fishing gear. As explained above, a sturgeon would need to travel up to 17.3 km to swim outside the area where noise is above the threshold where behavioral disturbance is expected; this distance would result from a sturgeon being very near the source when pile driving started, it is more likely that the distance traveled would be smaller. As we do not expect vessel strike to occur in the open ocean, regardless of traffic levels, we do not expect any increase in risk of vessel strike even if a sturgeon was displaced into an area with higher vessel traffic. Based on the available information on the distribution of fishing activities that may interact with sturgeon (i.e., gillnets, trawl), it is extremely unlikely that a sturgeon avoiding pile driving noise would be more at risk of entanglement or capture than had it not been exposed to the noise source. This is because the distance that a sturgeon would need to move to avoid potentially disturbing level of noise would not put the individual in areas with higher levels of trawl or gillnet fishing than in the WDA (see

Figure G-11 in DNV GL 2021/COP Appendix X). Based on this analysis, all effects to Atlantic sturgeon from exposure to impact pile driving noise are expected to be extremely unlikely, or so small that they cannot be meaningfully measured, detected, or evaluated and are, therefore, insignificant. Take is not anticipated as a result of exposure to noise from impact or vibratory pile driving for WTG or OSP foundation installation.

UXO/MEC Detonation

Injury to fish from exposures to blast pressure waves is attributed to compressive damage to tissue surrounding the swim bladder and gastrointestinal tract, which may contain small gas bubbles. For UXO detonations, modeling (Hannay and Zykov 2022) was conducted as described above to estimate the distances to thresholds used to evaluate onset of injury due to peak pressure exposures for various UXO charge sizes with 10 dB mitigation (Table 7.1.45).

Table 7.1.45 Maximum range to thresholds used to evaluate onset of injury for Atlantic sturgeon exposed to underwater explosives.

Onset of Injury	Maximum distance to Lpk threshold exceedance (m)				
	E4 (2.3 kg)	E6 (9.1 kg)	E8 (45.5 kg)	E10 (227 kg)	E12 (454 kg)
Lpk, 0-pk, flat: 229 dB re 1uPa	49	80	135	230	290

Source: Table 45 in Hannay and Zykov 2022.
Note: distances reported as for "all sites"

No density estimates for Atlantic sturgeon are available for the action area or for any area that could be used to estimate density in the action area. Therefore, it was not possible to conduct an exposure analysis to predict the number of Atlantic sturgeon likely to be exposed to any of the thresholds identified here.

Injury to fish from exposures to blast pressure waves is attributed to compressive damage to tissue surrounding the swim bladder and gastrointestinal tract, which may contain small gas bubbles. In order to be exposed to blast pressure that could result in injury, a sturgeon would need to be within 49-290 m of the UXO being detonated, depending on charge size. Given the dispersed and transient nature of Atlantic sturgeon in the area, the placement of bubble curtains or other NAS at a distance from the UXO, and that no more than 10 detonations are anticipated, it is extremely unlikely that a sturgeon would be close enough to any detonation to experience injury or mortality.

Given the extremely short duration of a UXO detonations (approximately one second), any behavioral response of sturgeon is expected to be limited to a brief startle and change in swimming direction, with resumption of normal behavior as soon as the explosion is complete. Given the brief exposure, effects to Atlantic sturgeon are so small that they could not be meaningfully measured, detected, or evaluated and are insignificant. Take of Atlantic sturgeon is not anticipated to occur as a result of exposure to UXO detonations.

Vessel Noise and Cable Installation
The vessels used for the proposed project will produce low-frequency, broadband underwater sound below 1 kHz (for larger vessels), and higher-frequency sound between 1 kHz to 50 kHz (for smaller vessels), although the exact level of sound produced varies by vessel type. Noise produced during cable installation is dominated by the vessel noise; therefore, we consider these together. Vessels operating with dynamic positioning thrusters produce peak noise of 171 dB SEL peak at a distance of 1 m, with noise attenuating to below 150 dB rms at a distance of 135 m (BOEM 2021, see table 23).

In general, information regarding the effects of vessel noise on fish hearing and behaviors is limited. Some TTS has been observed in fishes exposed to elevated background noise and other white noise, a continuous sound source similar to noise produced from vessels. Caged studies on sound pressure sensitive fishes show some TTS after several days or weeks of exposure to increased background sounds, although the hearing loss appeared to recover (e.g., Scholik and Yan 2002; Smith et al. 2006; Smith et al. 2004b). Smith et al. (2004b) and Smith et al. (2006) exposed goldfish (a fish with hearing specializations, unlike any of the ESA-listed species considered in this opinion) to noise with a sound pressure level of 170 dB re 1 μPa and found a clear relationship between the amount of TTS and duration of exposure, until maximum hearing loss occurred at about 24 hours of exposure. A short duration (e.g., 10-minute) exposure resulted in 5 dB of TTS, whereas a three-week exposure resulted in a 28 dB TTS that took over two weeks to return to pre-exposure baseline levels (Smith et al. 2004b). Recovery times were not measured by researchers for shorter exposure durations, so recovery time for lower levels of TTS was not documented.

Vessel noise may also affect fish behavior by causing them to startle, swim away from an occupied area, change swimming direction and speed, or alter schooling behavior (Engas et al. 1998; Engas et al. 1995; Mitson and Knudsen 2003). Physiological responses have also been documented for fish exposed to increased boat noise. Nichols et al. (2015b) demonstrated physiological effects of increased noise (playback of boat noise) on coastal giant kelpfish. The fish exhibited acute stress responses when exposed to intermittent noise, but not to continuous noise. These results indicate variability in the acoustic environment may be more important than the period of noise exposure for inducing stress in fishes. However, other studies have also shown exposure to continuous or chronic vessel noise may elicit stress responses indicated by increased cortisol levels (Scholik and Yan 2001; Wysocki et al. 2006). These experiments demonstrate physiological and behavioral responses to various boat noises that have the potential to affect species' fitness and survival, but may also be influenced by the context and duration of exposure. It is important to note that most of these exposures were continuous, not intermittent, and the fish were unable to avoid the sound source for the duration of the experiment because this was a controlled study. In contrast, wild fish are not hindered from movement away from an irritating sound source, if detected, so are less likely to be subjected to accumulation periods that lead to the onset of hearing damage as indicated in these studies. In other cases, fish may eventually become habituated to the changes in their soundscape and adjust to the ambient and background noises.

All fish species can detect vessel noise due to its low-frequency content and their hearing capabilities. Because of the characteristics of vessel noise, sound produced from vessels is unlikely to result in direct injury, hearing impairment, or other trauma to Atlantic sturgeon. In addition, in the near field, fish are able to detect water motion as well as visually locate an oncoming vessel. In these cases, most fishes located in close proximity that detect the vessel either visually, via sound and motion in the water would be capable of avoiding the vessel or move away from the area affected by vessel sound. Thus, fish are more likely to react to vessel noise at close range than to vessel noise emanating from a greater distance away. These reactions may include physiological stress responses, or avoidance behaviors. Auditory masking due to vessel noise can potentially mask biologically important sounds that fish may rely on. However, impacts from vessel noise would be intermittent, temporary, and localized, and such responses would not be expected to compromise the general health or condition of individual fish from continuous exposures. Instead, the only impacts expected from exposure to project vessel noise for Atlantic sturgeon may include temporary auditory masking, physiological stress, or minor changes in behavior.

Therefore, similar to marine mammals and sea turtles, exposure to vessel noise for fishes could result in short-term behavioral or physiological responses (e.g., avoidance, stress). Vessel noise would only result in brief periods of exposure for fishes and would not be expected to accumulate to the levels that would lead to any injury, hearing impairment or long-term masking of biologically relevant cues. For these reasons, exposure to vessel noise is not expected to significantly disrupt normal behavior patterns (i.e., cause harassment) of Atlantic sturgeon in the action area or harm the species. Based on this analysis we have similarly determined that it is extremely unlikely that any Atlantic sturgeon will experience significant impairment of essential behavioral patterns. Thus, no take by harm is anticipated. The effects are so minor that they cannot be meaningfully measured, detected, or evaluated. Therefore, the effects of vessel noise on Atlantic sturgeon are considered insignificant and take will not occur.

Operation of WTGs

As described above, many of the published measurements of underwater noise levels produced by operating WTGs are from older geared WTGs and are not expected to be representative of newer direct-drive WTGs, like those that will be installed for the SouthCoast project. Elliot et al. (2019) reports underwater noise monitoring at the Block Island Wind Farm, which has direct-drive GE Haliade turbines the loudest noise recorded was 126 dB re 1uPa at a distance of 50 m when wind speeds exceeded 56 kmh. As noted above, based on wind speed records within the WDA (SouthCoast COP, Appendix X Table 7-1), wind speeds in the WDA exceed 55.6 kph (30 knots) less than 1% of the time; the 0-year mean wind speed at 10 m elevation is 7.2 m/s (26 kph or 14 kts). Elliot et al. note that based on monitoring of underwater noise at the Block Island site, the noise levels identified in the vicinity of the turbine are far below any numerical criteria for adverse effects on fish. Similarly, in a review of data from 27 operational wind farms in the North Sea (turbines between 2.3 and 8 MW), the mean (broadband) total SPL (SPL50 or L50) at nominal power of the turbines varied between 112 and 131 dB (median and mean value 120 dB). HDR 2023 found that noise levels recorded during the 6 MW CVOW turbine operations ranged from 120 to 130 dB re 1 μPa except during storms, when the received levels increased to 145 dB re 1 μPa. Recorded particle acceleration levels were compared to published behavioral audiograms of selected fish species and were found to be below the respective hearing thresholds for these species. Together, these publications are the best available data for estimating operational noise of the SouthCoast turbines. As underwater noise associated with the operation of the WTGs is expected to be below the thresholds for injury or behavioral disturbance for Atlantic sturgeon, we do not expect any impacts to any Atlantic sturgeon due to noise associated with the operating turbines. Additionally, we note that many studies of fish resources within operating wind farms, including the Block Island Wind Farm, and wind farms in Europe with the older, louder geared turbines report localized increases in fish abundance during operations (due to the reef effect; e.g., Stenberg et al. 2015, Methartta and Dardick 2019, Wilber et al. 2022). This data supports the conclusion that operational noise is not likely to result in the displacement or disturbance of Atlantic sturgeon. Based on these considerations, effects of operational noise on Atlantic sturgeon are extremely unlikely to occur and are discountable.

HRG Surveys
Some of the equipment that is described by BOEM for use for surveys produces underwater noise that can be perceived by Atlantic sturgeon. Of the equipment that is proposed by SouthCoast, this is limited to boomers, sparkers, and some sub-bottom profilers. Extensive information on HRG survey noise and potential effects of exposure to Atlantic sturgeon is provided in NMFS June 29, 2021 programmatic ESA consultation on certain geophysical and geotechnical survey activities (NMFS GAR 2021, Appendix C to this Opinion). We summarize the relevant conclusions here. For the equipment proposed for use, the maximum distance to the injury threshold (peak) is 9 m and the maximum distance to the 150 dB re 1uPa behavioral disturbance threshold is approximately 2 km for the loudest equipment (sparker).

Table 7.1.46 Largest PTS Exposure Distances from mobile HRG Sources at Speeds of 4.5 knots – Fish

HRG Source	Highest Source Level (dB re 1 µPa)	Distance to Fish Thresholds in m (FHWG 2008)		
		Peak	*SEL*	*Behavior (150 dB re 1uPa rms)*
Boomers	176 dB SEL 207 dB RMS 216 PEAK	3.2	0	708
Sparkers	188 dB SEL 214 dB RMS 225 PEAK	9	0	1,996[a]
CHIRP sub-bottom profilers	193 dB SEL 209 dB RMS 214 PEAK	NA	NA	32
Multi-beam echosounder (100 kHz)	185 dB SEL	NA	NA	NA

Multi-beam echosounder (>200 kHz) (mobile, non-impulsive, intermittent)	182 dB SEL	NA	NA	NA
Side-scan sonar (>200 kHz) (mobile, non-impulsive, intermittent)	184 dB SEL	NA	NA	NA

a – the calculated distance to the 150 dB rms threshold for the Applied Acoustics Dura-Spark is 1,996m; however, the distances for other equipment in this category is significantly smaller
NA = not applicable due to the sound source being out of the hearing range for the group.

As explained above, the available information suggests that for noise exposure to result in physiological impacts to the fish species considered here, received levels need to be at least 206 dB re: 1uPa peak sound pressure level (SPLpeak) or at least 187 dB re: u1Pa cumulative. The peak thresholds are exceeded only very close to the noise source (<3.2 m for the boomers/sub-bottom profilers and <9 m for the sparkers; the cumulative threshold is not exceeded at any distance). As such, in order to be exposed to peak sound pressure levels of 206 dB re: 1uPa from any of these sources, an individual fish would need to be within 9 m of the source. This is extremely unlikely to occur given the dispersed nature of the distribution of ESA-listed Atlantic sturgeon in the action area, the use of a ramp up procedure, the moving and intermittent/pulsed characteristic of the noise source, and the expectation that ESA-listed fish will swim away, rather than towards the noise source. Based on this, no physical effects to any Atlantic sturgeon, including injury or mortality, are expected to result from exposure to noise from the geophysical surveys; we consider the potential for effects on behavior below.

The calculated distances to the 150 dB re: 1 uPa rms threshold for the boomers, sparkers, and sub-bottom profilers is 708 m, 1,996 m, and 32 m, respectively (Table 7.1.37). It is important to note that these distances are calculated using the highest power levels for each sound source reported in Crocker and Fratantonio (2016); thus, they likely overestimate actual sound fields, but are still within a reasonable range to consider.

Because the area where increased underwater noise will be experienced is transient (because the survey vessel towing the equipment is moving), increased underwater noise will only be experienced in a particular area for a short period of time. Given the transient and temporary nature of the increased noise, we expect any effects to behavior to be minor and limited to a temporary disruption of normal behaviors, potential temporary avoidance of the ensonified area and minor additional energy expenditure spent while swimming away from the noisy area. If foraging, resting, or migrations are disrupted, we expect that these behaviors will quickly resume once the survey vessel has left the area (i.e., in seconds to minutes, given its traveling speed of 3 – 4.5 knots). Therefore, no fish will be displaced from a particular area for more than a few minutes. While the movements of individual fish will be affected by the sound associated with the survey, these effects will be temporary and localized. These fish are not expected to be excluded from any particular area, and there will be only a minimal impact on foraging, migrating, or resting behaviors. Sustained shifts in habitat use, distribution, or foraging success are not expected. As established above, no injury or mortality is anticipated to result from exposure to noise from HRG surveys. Effects to individual fish from brief exposure to potentially disturbing levels of noise are expected to be limited to a brief startle or short displacement and will be so small that they cannot be meaningfully measured, detected, or evaluated; therefore, effects of exposure to survey noise are insignificant. Take is not anticipated to occur.

7.1.6 Effects of Noise on Prey

The ESA listed species in the WDA forage in varying frequencies and intensities on a wide variety of prey. With the exception of fish, little information is available on the effects of underwater noise on many prey species, such as most benthic invertebrates and zooplankton, including copepods and krill. Effects to schooling fish that are preyed upon by some whale species are likely to be similar to the effects described for Atlantic sturgeon. However, given that these smaller fish species are more abundant and have a greater biomass throughout the area where increased underwater noise will be experienced, it is possible that there may be some mortality or injury of some fish. However, we only expect this to occur as a result of the UXO detonations. Given that fish would need to be within 290 m of the detonation to be seriously injured or killed (see Table 45 in Hannay and Zykov 2022), and that no more than 10 detonations will occur, any effects to the abundance or distribution of potential fish prey are likely to be so small that they cannot be meaningfully measured, evaluated, or detected. Fish may also react behaviorally to the noise sources discussed here and move away from loud noise sources, such as pile driving and UXO detonations. However, like Atlantic sturgeon, we expect these disturbances and changes in distribution to be temporary and not represent any reduction in biomass or reduction in the availability of prey. Most benthic invertebrates have limited mobility or move relatively slowly compared to the other species considered in this analysis. As such, there may be some small reductions in prey for sea turtles and Atlantic sturgeon as a result of exposure of benthic prey species to pile driving noise. However, these reductions are expected to be small and limited to the areas immediately surrounding the piles being installed. We expect that the effects to Atlantic sturgeon and loggerhead and Kemp’s ridley sea turtles from any small and temporary reduction in benthic invertebrates due to exposure to pile driving noise or UXO detonations to be so small that they cannot be meaningfully measured, detected, or evaluated and are therefore insignificant. No take is anticipated as a consequence of disturbance to prey.

We are not aware of any information on the effects of pile driving or UXO noise exposure to krill, copepods, or other zooplankton. McCauley et al. (2017) documented mortality of juvenile krill exposed to seismic airguns. No airguns are proposed as part of the SouthCoast project. We expect that zooplankton that are within close proximity to the UXO detonations may be killed. We are not aware of any evidence that pile driving noise, HRG surveys, or the other noise sources considered here are likely to result in the mortality of zooplankton. Based on the available data, we expect the mortality of zooplankton to be limited to exposure to the 10 UXO detonations and that losses will be limited due to the small number of detonations (10) and the extremely short duration of the explosion (one second). Effects to marine mammals due to disturbance of prey are expected to be so small that they cannot be meaningfully measured, detected, or evaluated and are therefore insignificant. No take is anticipated to occur.

Similarly, we expect that any effects of operational noise on the prey of ESA listed species to be extremely unlikely or so small that they cannot be meaningfully measured, detected, or evaluated. As described above, many of the published measurements of underwater noise levels produced by operating WTGs are from older geared WTGs and are not expected to be representative of newer direct-drive WTGs, like those that will be installed for the SouthCoast project. Elliot et al. (2019) reports underwater noise monitoring at the Block Island Wind Farm, which has direct-drive GE Haliade turbines the loudest noise recorded was 126 dB re 1uPa at a distance of 50 m when wind speeds exceeded 56 kmh. As noted above, based on wind speed records within the WDA (SouthCoast COP, Appendix X Table 7-1), wind speeds in the WDA exceed 55.6 kph (30 knots) less than 1% of the time; the 0-year mean wind speed at 10 m elevation is 7.2 m/s (26 kph or 14 kts). Elliot et al. note that based on monitoring of underwater noise at the Block Island site, the noise levels identified near the turbine are far below any numerical criteria for adverse effects on fish. Similarly, in a review of data from 27 operational wind farms in the North Sea (turbines between 2.3 and 8 MW), the mean (broadband) total SPL (SPL50 or L50) at nominal power of the turbines varied between 112 and 131 dB (median and mean value 120 dB). HDR 2023 found that noise levels recorded during the 6 MW CVOW turbine operations ranged from 120 to 130 dB re 1 μPa except during storms, when the received levels increased to 145 dB re 1 μPa. Recorded particle acceleration levels were compared to published behavioral audiograms of selected fish species and were found to be below the respective hearing thresholds for these species. Together, these publications are the best available data for estimating operational noise of the SouthCoast turbines. As underwater noise associated with the operation of the WTGs is expected to be below the thresholds for injury or behavioral disturbance for fish species, we do not expect any impacts to any fish species due to noise associated with the operating turbines. There is no information to indicate that operational noise will affect krill, copepods, or other zooplankton. Additionally, we note that many studies of fish and benthic resources within operating wind farms, including the Block Island Wind Farm, and wind farms in Europe with the older, louder geared turbines report localized increases in fish and benthic invertebrate abundance during operations (due to the reef effect; e.g., Stenberg et al. 2015, Methartta and Dardick 2019, Wilber et al. 2022). This data supports the conclusion that operational noise is not likely to result in the displacement or disturbance of prey species. As effects to prey from operational noise on prey are extremely unlikely, effects to ESA listed species resulting from impacts to prey are also extremely unlikely and therefore, discountable.

7.2 Effects of Project Vessels

In this section we consider the effects of the operation of project vessels on listed species in the action area by describing the existing vessel traffic in the action area (i.e., as previously summarized in the *Environmental Baseline*), estimating the anticipated increase in vessel traffic associated with construction/installation, operations/maintenance (O&M), and decommissioning of the project (based on the information provided in BOEM's BA), and then analyzing risk and determining likely effects to listed whales, sea turtles, and Atlantic sturgeon. We also consider impacts to air quality from vessel emissions and whether those impacts may cause effects to listed species. In Section 3 of this Opinion, we described proposed vessel use over all phases of the project as informed by BOEM's BA; that information is summarized here. In the BA, BOEM describes vessel activities during the construction/installation, operations and maintenance, and decommissioning phases of the project. BOEM did not identify any vessel types or trips that would not be subject to conditions of COP approval or otherwise not considered effects of the action considered here. Effects of project noise, including from vessels, were considered in Section 7.1, and are not repeated here. As considered here, project vessel trips are vessel transits that would not occur but for the proposed action; that is, these are vessels that are operated by SouthCoast Wind, or under contract to SouthCoast Wind, or otherwise engaged in activities that are described in the COP or other project permits, authorizations, or approvals.

7.2.1 Project Vessel Descriptions and Increase in Vessel Traffic from Proposed Project

Descriptions of project vessel use and traffic are described in Section 3 of this Opinion and summarized here for reference. Project vessels will operate in distinct areas within the action area over the life of the project. According to the information presented in the BA, the majority, if not all, vessel transits during the construction period will occur between the WDA and ports located in Salem, New Bedford, and Fall River, Massachusetts; Davisville and Providence, Rhode Island; and New London, Connecticut; with a smaller number of trips between the WDA and more distant ports in Sparrows Point, Maryland; Charleston, South Carolina; and Corpus Christi, TX and Altamira, Mexico in the Gulf of Mexico. The BA also describes the potential for trips from ports in Asia, eastern Canada, and Europe. See Figure 7.2.1 for locations of ports identified for use in the BA. Transits during the O&M phase will primarily be between the WDA and the O&M facility which is proposed to be located in New Bedford, Massachusetts; Fall River, Massachusetts; Providence, Rhode Island; or New London, Connecticut, with the potential for occasional repair and delivery trips originating from ports in Davisville, Rhode Island; Salem, Massachusetts; Sparrows Point, Maryland; and Charleston, South Carolina. We note that if there is an unexpected, non-routine maintenance event, a vessel may travel to the project site from an additional location; however, it is not possible to predict when or where such unanticipated trips may occur and therefore, neither the trips nor their effects are reasonably certain to occur and therefore do not meet the definition of "effects of the action" and are not considered here, 50 CFR 402.02; 402.17. As described in the BA, the locations of ports used for decommissioning are unknown at this time; however, we know that vessels supporting decommissioning would operate in and around the WDA. Thus, we have considered an increase in traffic during the decommissioning period in the general area in and around the WDA, including between the WDA and ports identified for use during the O&M phase.

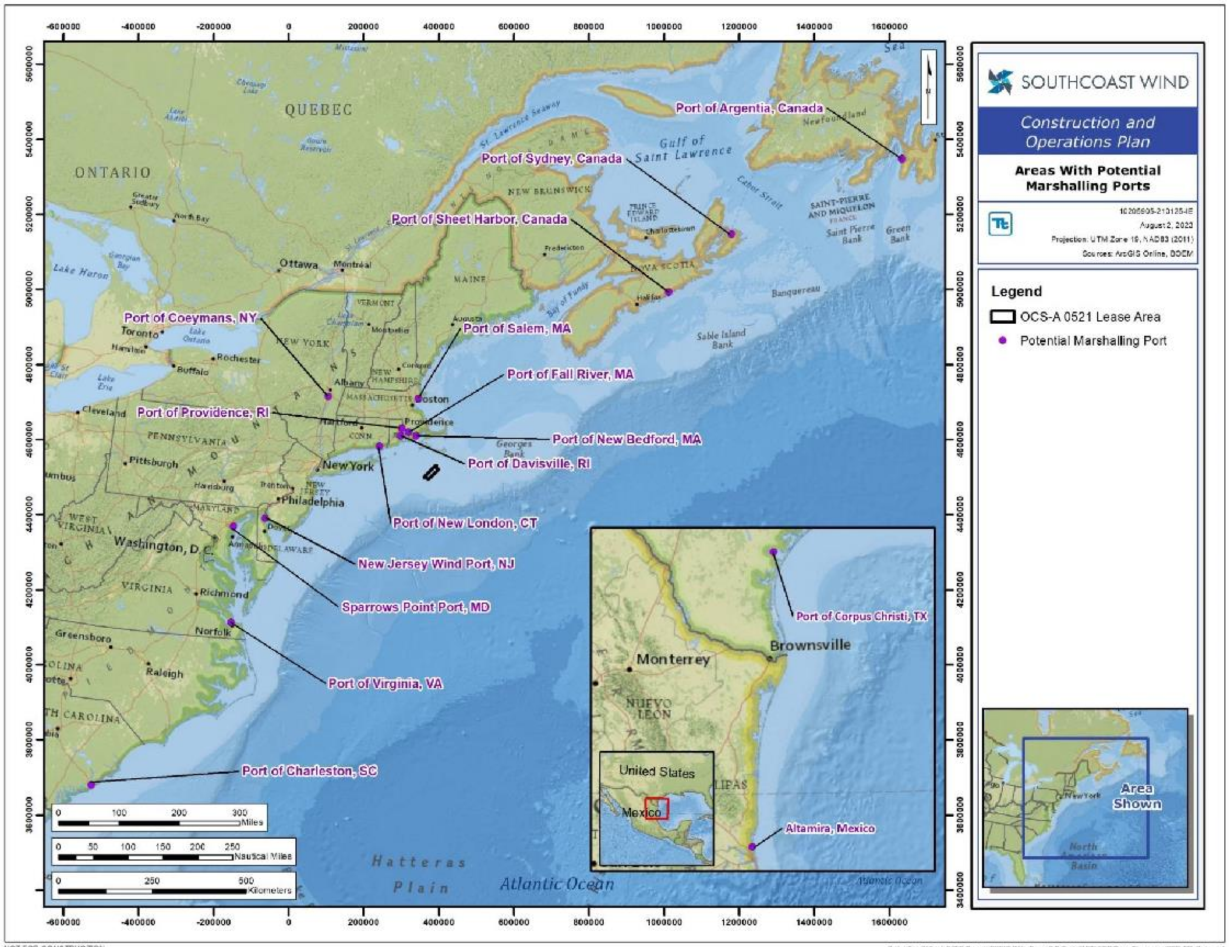


Figure 7.2.1. Port Facilities under Consideration for Project Construction and Installation and O&M Support (Unidentified ports in Europe and Asia may also be utilized). Note Port of Coeymans, New Jersey Wind Port and Port of Virginia are no longer proposed for use and trips to/from these ports are not considered as part of the proposed action.
Source: *SouthCoast Wind Farm and Export Cable – Development and Operation. COP Figure 3-38.*

Vessel traffic will occur in the WDA and between the WDA and the ports used to support SouthCoast Wind construction, operations and maintenance, and decommissioning; these ports were identified in BOEM's BA. Not all vessels will utilize all ports under consideration, the number of possible vessels, approximate length, role, and vessel type is shown in Table 7.2.1, and the potential ports to be used during construction is shown in Table 7.2.2.

As explained in Section 3, transits of scour protection, dredging, and heavy transport vessels may occur between ports in eastern Canada, Europe, Asia, Mexico, and/or the WDA or one of the identified US ports during the construction phase. In this section, we consider the effects of the portion of those vessel transits that are within the U.S. Atlantic EEZ (see explanation for bounding the action area for vessel transit in Section 3.9 of this Opinion).

Table 7.2.1. Potential Vessel Roles, Types, and Estimated Total Number of Vessels to Support Construction Activities and O&M.

Vessel Role	Vessel Type	Number of Vessels
Anchor Handling/Support	Tug	1-10
Transportation and installation of EC and IAC	Cable Lay Barge	1-3
Transportation and installation of EC and IAC	Cable Transportation and Lay Vessel	1-5
Crew Transport/General Operations	Crew Transport Vessel (CTV)	2-5
Seabed preparation, inspection, and installation	Dredging Vessel	1-5
Transport, transfer and installation of substructures, WTGs, and OSPs	Heavy Lift Crane Vessel	1-5
Transportation of project component	Heavy Transport Vessel	1-20
Commissioning activities	Jack-up Vessel	1-2
Commissioning activities	DP Accommodation Vessel	1-2
Seabed preparation, inspection, installation, and general support	Multipurpose Support Vessel	1-8
Scour protection installation	Scour Protection Installation Vessel	1-2
Commissioning, general operations	Service Operations Vessel (SOV)	1-4
Specialized survey work	Survey Vessel	1-5
Transportation to site from staging port, port operations	Tugboat	1-12
Transpiration of components to site from staging port	Barge	1-6
O&M	SOV	1
	CTV	1-4
	Jack-up vessel	1-2
	Inspection/survey vessel	1-2
	Cable-laying vessel	1-2
	Scour vessel or barge	1

Source: SouthCoast COP and SouthCoast BA

As described in Section 3 (Table 3.5), during the construction phase a variety of vessels will be used including installation and transport vessels that may transit between 2-35 knots (when not subject to a speed restriction); these vessels range from 25 to 300 meters in length (COP, Table 3.21). The larger installation vessels, such as the heavy lift crane vessel and dredging vessel, will generally travel to and from the construction area in the WDA at the beginning and end of the wind turbine and cable construction/installation and will not make transits to port on a regular basis. Heavy transport vessels carrying project components (e.g. foundations, WTG and OSP components) will likely make trips between foreign ports and regional ports in New England for staging or directly to the WDA for installation. Tugs and barges transporting construction equipment and components will make more frequent trips (e.g., weekly) from regional ports to the project site while smaller support vessels carrying supplies and crew may make trips to the SouthCoast Wind WDA even more frequently. However, we note that construction crews assembling the WTGs may hotel onboard installation vessels at sea thus limiting the number of crew vessel transits expected during wind farm installation. Within the SouthCoast Wind WDA, many vessels will be stationary or moving 8 knots or less. Construction of the offshore export cables will utilize various vessel types including a cable-laying vessel, tugs, barges, and work and transport vessels from numerous different ports (see Table 3.5 and Table 7.2.2).

Table 7.2.2. Potential Ports and Usage during the SouthCoast Wind Construction and Installation Phase.

Ports	Number of vessel trips per project phase		
	C	O&M	D
Port of Salem, MA	15	117	618
Port of New Bedford, MA	1,125	8,066	931
Port of Fall River, MA	929	2,390	554
Port of Davisville, RI	162	284	N/A
Port of Providence, RI	387	635	377
Port of New London, CT	1,491	8,540	1,113
Sparrows Point Port, MD	8	2	N/A
Port of Charleston, SC	8	2	N/A
Port of Corpus Christi, TX	35	N/A	9
Port of Altamira, Tamaulipas, Mexico	36	N/A	N/A
Canada	109	21	55
Panama Canal	3	N/A	7
Europe and Asia	64	37	55
Totals	4,372	20,094	3,719

C = Construction O&M = Operations and Maintenance, D = Decommissioning
Source: BOEM SouthCoast Wind BA Table 3.1-14

In presenting this information in the BA, BOEM notes that at this time it is difficult to predict the exact number of trips to/from each identified port. They state that, "A higher percentage of the total anticipated vessel trips per vessel type were allotted to ports that have a higher chance of being selected. To avoid significantly overestimating the number of trips per vessel type, trips were not duplicated for the scenarios where multiple ports are under consideration. Where multiple ports are considered to have a high chance of selection, additional trips were added to those ports per vessel type to ensure SouthCoast Wind did not significantly underestimate the potential vessel trips from that port." This approach resulted in the estimates included in Table 7.2.2 above (Table 3.1-14 in the BA). We note that this approach may result in over-estimates of the total number of vessel trips if it results in scenarios that are not realized (for example, if rather than 8 trips to Charleston and 8 trips to Sparrows Point, there are 8 trips to only one of these ports or 8 trips spread between the two ports). However, this is the best available information we have on the number of vessel trips and therefore we use it for our analysis here. We also note that the table in the BA identifies the construction period as 5 years, the O&M period as 33 years, and the decommissioning period as 5 years. Elsewhere in the BA, BOEM refers to the construction and installation period extending over approximately 7 years; during the consultation period we confirmed with BOEM that construction and installation vessels may be operating over an approximately 7-year period beginning shortly after COP approval. In the BA, BOEM refers to both a 33 and 35-year operational period. Note that the amount of vessel traffic per phase would not change based on the length of the project phase; the only difference would be that if the trips occurred over a longer period there would be fewer trips per year.

During the O&M phase, approximately 130 trips per year to the WDA will occur to carry out inspections and maintenance for Project 1 and Project 2 WTGs, OSPs, and cables. The majority of vessel trips over the O&M period would originate from the O&M facility, which is described in the BA as being located in Fall River, MA; New Bedford, MA; Providence, RI; or New London, CT. Helicopters, airplanes, or drones may also be used for aerial inspections. Jack-up vessels, cable-lay/cable burial vessels, crew transport vessels, and support barges may be used on an as-needed basis for major repairs. Typical length and operational speeds for O&M vessel types are expected to be similar to those for equivalent vessels used during construction.

As described in the BA, the number and type of vessels required for project decommissioning would be similar to those used during project construction, with the exception that impact pile driving would not be required. As such, while the same class of vessel used for foundation installation may be used for decommissioning, that vessel would not be equipped with an impact hammer. In the BA, BOEM states that the same ports are anticipated to be used for decommissioning as for construction, except SouthCoast Wind does not anticipate vessel trips from the ports of Davisville, Rhode Island; Sparrows Point, Maryland; Charleston, South Carolina; or Altamira, Mexico.

The maximum total estimated vessel trips during the construction period are 4,372; these trips will be between the SouthCoast Wind WDA and the ports identified above. During the decommissioning period, the number and types of vessels required would be similar to those described for the construction and installation period (3,719 trips). As explained in Section 6, the best available information indicates there are approximately 29,734 vessel tracks annually in the WDA and surrounding waters where the majority of SouthCoast Wind vessels will conduct work (COP Appendix X; USCG MARI PARS 2020). Additional information on vessel traffic in the area is also presented in BOEM's BA. Table 7.2.3 below describes the calculated increase in traffic in this area attributable to SouthCoast Wind project vessels during each project phase.

Table 7.2.3. Percent Increase above Baseline Vessel Traffic in the WDA Due to SouthCoast Wind Project Vessels

Phase	Estimated Annual Project-Related Vessel Transits	Phase Duration	% Increase in Annual Vessel Transits in the WDA and Surrounding Area[d]
Construction	624-875[a]	5-7 years	2.09 - 2.94%
O&M	574-609[b]	33-35 years	1.9 - 2.05%
Decommissioning	744[c]	5 years	2.50%

[a] Source: BOEM 2023 BA Table 3.1-14 (4,372 total trips divided by 5 or 7 years of construction)
[b] Source: BOEM 2023 BA Table 3.1-14 (20,094 total trips divided by 33 or 35 years of O&M)
[c] Source: BOEM 2023 BA Table 3.1-14 (3,719 total trips divided by 5 years of decommissioning)
[d] Source: Baseline vessel traffic in the SouthCoast Wind WDA and surrounding area where the majority of project vessels will operate is based on 29,734 transits per year (USCG 2020).

7.2.2 Minimization and Monitoring Measures for Vessel Operations

There are a number of measures that SouthCoast Wind is proposing to take and/or BOEM is proposing to require as conditions of COP approval that are designed to avoid, minimize, or monitor effects of the action on ESA listed species during construction, operation, and decommissioning of the project. The measures that SouthCoast Wind is proposing to take and/or BOEM is proposing to require as conditions of COP approval, apply to all vessels operating within the U.S. EEZ carrying out activities described in the COP. BOEM has not identified any exceptions to requirements for compliance with the vessel strike avoidance measures included in the BA other than standard exceptions for crew/vessel safety. NMFS OPR's proposed MMPA ITA also contains requirements for vessel strike avoidance measures for marine mammals; these measures will be required over the 5 year effective period of the ITA and are applicable in the Specified Geographic Region (the Mid-Atlantic Bight [including the WDA and regional ports] extending westward into the Atlantic Ocean to the 100-m isobath and vessel transit routes to marshaling ports in Charleston, South Carolina and Sheet Harbor, Canada). The measures incorporated into the proposed action include: applicant proposed measures, and measures proposed by BOEM as conditions of COP approval or NMFS OPR as mitigation in its proposed ITR. Other applicable mandatory measures are required by existing regulation. Collectively, these minimization measures fall into the following general categories: speed reductions, monitoring for animals in the vessel's path, separation distances between vessels and animals, actions to be taken when an animal is sighted, and increased situational awareness. The complete list of measures that are part of the proposed action is provided in Appendices A, B, and C of this Opinion. The measures described below are all considered part of the proposed action or are otherwise required by regulation (62 FR 6729, February 13, 1997), (66 FR 58066, November 20, 2001), (73 FR 60173, October 10, 2008).

Speed Restrictions

As described in the BA, the following speed restrictions will be in place during all phases of the project (unless specified) throughout the action area:

- Year round, all vessels, regardless of size, will comply with 10 knot speed restrictions in any Seasonal Management Area (SMA), Dynamic Management Area (DMA), or Slow Zone (visually or acoustically triggered).

- From November 1 – April 30, all project vessels will operate at speeds of 10 knots or less. Exceptions to this speed restriction are limited to:
    - vessels operating in Narragansett Bay or Long Island Sound (as North Atlantic right whales are extremely rare in these waters); and
    - situations in which there is a demonstrated risk to the health and safety of the vessel and/or crew.

- All vessels, regardless of size will reduce vessel speed to 10 knots or less (when not required to travel 10 knots or less) to maintain the 500-m minimum separation distance between the vessel and any ESA listed whale.

- Outside of the November 1 – April 30 period and when no other speed restrictions are in place, if a vessel is traveling at any speed greater than 10 knots (i.e., no speed restrictions are enacted) in a transit corridor (defined as a specific route from a port to the Lease Area or return), in addition to the required dedicated visual observer, SouthCoast Wind must monitor the transit corridor in real-time with PAM prior to and during transits. As required by BOEM and NMFS OPR, SouthCoast must prepare, submit and receive concurrence with a Vessel Strike Avoidance Plan that contains a complete description of their PAM protocols prior to conducting vessel transits in excess of 10 knots in transit corridors. Details for implementation of the PAM component were not included in the proposed MMPA ITA or the BA.
    - If a North Atlantic right whale is detected via visual observation or PAM within or approaching the transit corridor, all vessels in the transit corridor must travel at 10 knots or less for 24 hours following the detection. Each subsequent detection shall trigger a 24-hour reset. A slowdown in the transit corridor expires when there has been no further North Atlantic right whale visual or acoustic detection in the transit corridor in the past 24 hours.
    - The detection zone size (where a vessel mitigation action will be implemented) will be defined based on the efficacy of PAM equipment deployed and subject to NMFS concurrence as part of the Vessel Strike Avoidance Plan.

- During the 5-year period of the MMPA ITA, at times when vessels are not required to travel 10 knots or less (i.e. traveling within a PAM transit corridor May 1- October 31), all vessel operators, regardless of their vessel's size, must immediately reduce vessel speed to 10 knots or less for at least 24 hours when a North Atlantic right whale is sighted at any distance by any project-related personnel or acoustically detected by any project-related PAM system. Each subsequent observation or acoustic detection shall trigger an additional 24-hour period. If a North Atlantic right whale is reported by project personnel or via any of the monitoring systems within 10 km of a transiting vessel, that vessel must operate at 10 knots or less for 24 hours following the reported detection.

Monitoring and Lookouts

Monitoring and trained lookouts are required for all project vessels operating in the action area during all phases of the project.

- All vessel crew members and trained lookouts (PSOs, dedicated visual observers) must receive training on the identification of marine mammals, sea turtles, and listed fish, all vessel strike avoidance mitigation requirements (e.g. speed restrictions, separation distances), methods for monitoring for protected species, and communication and reporting protocols.

- All transiting vessels operating at any speed must have a trained lookout on duty at all times to monitor for marine mammals within a 180 degrees (°) direction of the forward path of the vessel (90° port to 90° starboard) located at an appropriate vantage point for ensuring vessels are maintaining required separation distances. The dedicated visual observer must not have any other duties while the vessel is transiting.

- Alternative monitoring technology, such as night vision and thermal cameras, will be available to the trained lookout to ensure effective monitoring at night and in any other low visibility conditions.

- At the onset of transits and while underway, all vessel operators and trained lookouts must check for notifications about protected species and vessel speed management measures. These media may include, but are not limited to: NOAA weather radio, U.S. Coast Guard NAVTEX and Channel 16 broadcasts, Notices to Mariners, the Whale Alert app, or WhaleMap website. Information about active SMAs and DMAs/Slow Zones can be accessed at: https://www.fisheries.noaa.gov/national/endangered-species-conservation/reducing-vessel- strikes-north-atlantic-right-whale.

- Whenever multiple Project vessels are operating, any visual detections of protected species will be communicated in near real time to PSOs, vessel captains, or both associated with other Project vessels for situational awareness.

Separation Distances
Separation distances are required for all project vessels operating in the action area during all phases of the project.

- At all times a vessel is transiting, a 500-meter Vessel Strike Avoidance Zone for ESA listed species (minimum separation distances) must be monitored by a trained lookout.

- If an ESA listed whale or large unidentified whale is identified within 500 meters of the forward path of any vessel (90 degrees port to 90 degrees starboard), the vessel operator must immediately implement strike avoidance measures and steer a course away from the whale at 10 knots or less until the vessel reaches a 500 meter separation distance from the whale. Trained lookouts must notify the vessel captain of any whale observed or detected within 500 meters of the Project vessel. Upon notification, the vessel operator must immediately implement vessel strike avoidance procedures to maintain a separation distance of 500 meters or reduce vessel speed to allow the animal to travel away from the vessel.

- If an ESA listed large whale is sighted within 200 meters of the forward path of a vessel, the vessel operator must initiate a full stop by reducing speed and shift the engine to neutral. Engines must not be engaged until the whale has moved outside of the vessel's path and beyond 500 meters. If stationary, the vessel must not engage engines until the ESA listed large whale has moved beyond 500 meters.

- To minimize risk to sea turtles, if a sea turtle is sighted within 100 meters or less of the operating vessel's forward path, the vessel operator is required to slow down to 4 knots (unless unsafe to do so) and then proceed away from the turtle at a speed of 4 knots or less until there is a separation distance of at least 100 meters at which time the vessel may resume normal operations. If a sea turtle is sighted within 164 feet (50 meters) of the forward path of the operating vessel, the vessel operator must shift to neutral when safe to do so and then proceed away from the individual at a speed of 4 knots or less until there is a separation distance of at least 328 feet (100 meters), at which time normal vessel operations may be resumed. Additionally, vessel captains/operators must avoid transiting through areas of visible jellyfish aggregations or floating sargassum lines or mats. In the event that operational safety prevents avoidance of such areas, vessels would slow to 4 knots while transiting through such areas.

We note that a Vessel Strike Avoidance Plan and any PAM component will be subject to review and concurrence by BOEM and NMFS prior to implementation.

7.2.3 Assessment of Risk of Vessel Strike – Construction, Operations and Maintenance, and Decommissioning

Here, we consider the risk of vessel strike to ESA listed species from SouthCoast project vessels. This assessment incorporates the strike avoidance measures identified in Section 3, because they are considered part of the proposed action or are otherwise required by regulation. This analysis is organized by species group (i.e., Atlantic sturgeon, whales, and sea turtles) because the risk factors and effectiveness of strike avoidance measures are different for the different species groups. Within the species groups, the effects analysis is organized around the different geographic areas where project related vessel traffic would be experienced.

As noted in Section 2 of this Opinion and further addressed below, the effects of some vessel transits have been addressed in other Biological Opinions. Specifically, some SouthCoast Wind project vessels will utilize the Nexans Cable Plant in Charleston, SC, which was constructed pursuant to USACE permits. The Biological Opinion prepared by NMFS' SERO for the Nexans Plant (May 4, 2020, "2020 Nexans Opinion") considered effects of vessels transiting to/from the facility on shortnose sturgeon, Atlantic sturgeon, and critical habitat designated for the Carolina DPS of Atlantic sturgeon.

The 2020 Nexans Opinion analyzed an overall amount of vessel usage of the facility, of which SouthCoast Wind would contribute a small part. The effects analyzed in the completed Nexans Opinion has been considered as part of the *Environmental Baseline* of this Opinion, given the definition of that term at 50 CFR §402.02. The effects specific to SouthCoast Wind's vessel use of the port will be discussed here in this *Effects of the Action* section by referencing the analysis in the Nexans Opinion and determining whether the effects of SouthCoast Wind's vessels transiting to and from those ports are consistent with those analyses or anticipated to cause additional effects. As previously explained, by using this methodology, this Opinion ensures that all of the effects of SouthCoast Wind's vessel transits to and from the Nexans facility analyzed in other Opinion will be considered in the *Integration and Synthesis* section and reflected in this Opinion's final determination under ESA 7(a)(2). This methodology also ensures this Opinion does not "double-count" effects of SouthCoast Wind's vessel transits to and from the port–once in the Environmental Baseline and once here in this Opinion's *Effects of the Action* section. This approach is being taken because BOEM was not a party to the Nexans Biological Opinion consultation process, yet SouthCoast Wind's vessel transits would not occur but for BOEM's proposed COP approval with conditions; additionally, the Nexans Opinion does not identify specific users of the facility.

7.2.3.1 Atlantic Sturgeon

The distribution of Atlantic sturgeon does not overlap with the entirety of the action area. The marine range of Atlantic sturgeon extends from Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida with distribution largely from shore to the 50m depth contour (ASMFC 2006; Stein et al. 2004). Thus, Atlantic sturgeon only occur along a portion of the vessel routes described above and are absent from much of the deep-water offshore vessel routes.

Considering the area where project vessels will operate, Atlantic sturgeon may be present in nearshore waters along the U.S. Atlantic coast (depths less than 50 m), including the WDA, navigation channels within the Chesapeake Bay and/or Delaware Bay (for vessels transiting to/from Sparrows Point, MD), and Charleston Harbor and the Cooper River (vessels transiting to/from the Nexans cable facility). Atlantic sturgeon do not occur in the Gulf of Mexico.

Effects of Vessel Transits in the Lease Area, along the offshore Cable Corridor, and to/from Ports in MA, RI, and CT

While Atlantic sturgeon are known to be struck and killed by vessels in rivers and in estuaries adjacent to spawning rivers (e.g., Delaware Bay), we have no reports of vessel strikes in the marine environment. We have considered whether Atlantic sturgeon are likely to be struck by project vessels or if the increase in vessel traffic is likely to otherwise increase the risk of strike for Atlantic sturgeon in the action area.

As established elsewhere in this Opinion, Atlantic sturgeon are present within the WDA (described in Section 6.3 *Environmental Baseline*) and are transient, not resident, within the WDA and the coastal marine waters that will be transited by project vessels. The dispersed and transient nature of Atlantic sturgeon in this area means that the potential for co-occurrence between a project vessel and an Atlantic sturgeon in time and space in this portion of the action area is extremely low.

In order to be struck by a vessel, an Atlantic sturgeon needs to co-occur with the vessel hull or propeller in the water column. Given the depths in the vast majority of the marine waters that will be transited by project vessels (with the exception of nearshore areas where vessels will dock at ports along the coast of MA, RI, and CT and where Atlantic sturgeon are not expected to occur) and that sturgeon typically occur at or near the bottom while in the marine environment, the potential for co-occurrence of a vessel and a sturgeon in the water column is extremely low even if a sturgeon and vessel co-occurred generally. The areas to be transited by the project vessels are free flowing with no obstructions; this further reduces the potential for co-occurrence which further reduces the potential for strike. None of the nearshore port areas where vessels will potentially enter shallower water and dock or anchor (i.e., at the ports along the coast of MA, RI, and CT identified above), are known to be used by Atlantic sturgeon; as such, co-occurrence between any Atlantic sturgeon and any project vessels in areas near these landfall sites with shallow water or constricted waterways where the risk of vessel strike is theoretically higher, is extremely unlikely to occur. Considering this analysis, it is extremely unlikely that any project vessels operating in the WDA, along the cable corridors, or transiting to/from the ports identified in MA, RI, or CT, will strike an Atlantic sturgeon during any phase of the proposed project. We have also considered whether avoiding these project vessels increases the risk of being struck by non-project vessels operating in the action area. In order for this to occur, another vessel would have to be close enough to the project vessel such that the animal's evasive movements made it such that it was less likely to avoid the nearby vessel. Given common navigational safety practices (i.e., not traveling too close to other vessels to minimize the risk of collisions), it is extremely unlikely that another vessel would be close enough such that a sturgeon avoiding a project vessel would not be able to avoid another non-project vessel or that the risk of being struck by another non-project vessel would otherwise increase. Therefore, effects to Atlantic sturgeon of project vessels operating in this portion of the action area are extremely unlikely to occur and discountable.

Effects of Vessel Transits to Ports in the Chesapeake Bay (Baltimore - Sparrows Point, MD)
In the BA, BOEM indicates that up to eight vessel transits during the construction phase and two transits during operations and maintenance phase may occur between Sparrows Point, MD and the WDA. Sparrows Point is located near the mouth of the Patapsco River at the Port of Baltimore. Vessels traveling to/from this port will travel within the Federal navigation channels within Chesapeake Bay. Subadult and adult Atlantic sturgeon are seasonally present in portions of the Chesapeake Bay as they migrate between riverine habitats and the Atlantic Ocean. Little information is available on the risk of vessel strike in the upper Bay. Atlantic sturgeon are not known to occur in the Patapsco River itself.

The Port of Baltimore typically has over 100 vessel arrivals and departures per day[44] and had over 4,300 inbound and 4,300 outbound commerce-carrying vessel trips in 2019 (ACOE 2020). The maximum of eight vessel trips during construction and two trips during operations and maintenance SouthCoast Wind vessel trips in a given year represent approximately 0.19% and 0.05%, respectively, of the annual commerce-carrying vessel traffic traveling through the Chesapeake Bay to the Port of Baltimore and an even smaller percentage of the total vessel traffic in the Bay and at the Port. As the vessels will be using existing port facilities, there may not be an increase in vessel traffic at the Port or in the Chesapeake Bay and thus project related vessels are unlikely to increase the risk of a vessel strike as a result of the proposed project. Given this, it is extremely unlikely that a SouthCoast Wind vessel transiting within Chesapeake Bay to/from Sparrows Point will result in an increase of risk of vessel strike of an Atlantic sturgeon. This risk is further reduced by the geography of the Bay, which does not restrict Atlantic sturgeon distribution in the way that narrow or constricted river reaches may.

[44] https://www.marinetraffic.com/en/ais/details/ports/95?name=BALTIMORE&country=USA#Statistics; last accessed October 1, 2024.

As such, effects to Atlantic sturgeon from project vessels operating at Sparrows Point/Port of Baltimore or in the upper Chesapeake Bay are extremely unlikely to occur and are discountable. We consider vessel strike risk in the Chesapeake Bay entrance channels and the lower Bay below.

The USCG's 2021 Port Access Route Study for Approaches to the Chesapeake Bay, VA (USCG 2021, Enclosure 1), reports annual transits of the Chesapeake Bay entrance of 12,192 in 2017, 15,947 in 2018, and 16,811 in 2019 for an average of 14,983 annual transits through the mouth of Chesapeake Bay. Project vessels transiting to/from Sparrow's Point may transit through Chesapeake Bay; even if 8 trips occurred during a single year (which is the maximum number anticipated over the construction period), this would represent less than 0.06% of vessel traffic in this area. Given this very small increase in traffic and the similar very small potential increase in risk of strike and that is very close to zero, we have determined that vessel strike of an Atlantic sturgeon from a SouthCoast vessel transiting the Chesapeake Bay entrance channels and lower Bay is extremely unlikely to occur and effects are discountable.

Delaware Bay/Chesapeake and Delaware Canal

As an alternative to transiting to Sparrow's Point via the lower Chesapeake Bay, vessels could transit through Delaware Bay, then through the C&D canal, and then enter the upper Chesapeake Bay and transit to the Port of Baltimore/Sparrow's Point. We have considered whether the increase in vessel traffic that will result from the use of the Delaware Bay or C&D canal would increase vessel strikes of Atlantic sturgeon. Estimates of vessel traffic in the C&D canal including 25,000 total vessels annually and a reported annual number of trips for all vessels (self-propelled and non-self-propelled, all drafts) in the federal navigation channel from the Delaware River to Pooles Island in Chesapeake Bay ranging from 3,847 to 10,225 (median = 4,538) during the period from 2017 through 2021(USACE Waterborne Commerce Data 2023). Given the high amount of vessel traffic in the waterbody, and even just considering the median number of commercial one way trips, an increase of 8 trips (the maximum if all trips occurred in a single year) would result in an approximately 0.18% increase in vessel traffic. The actual percent increase in vessel traffic is likely even less considering that commercial traffic is only a portion of the vessel traffic in the canal (e.g., if the 25,000 vessel estimate is used the increase in traffic would represent a 0.03% increase). Given this very small increase in traffic and the similar very small potential increase in risk of strike and a calculated potential increase in the number of strikes that is very close to zero (despite likely being an overestimate), we have determined that vessel strike of an Atlantic sturgeon from a SouthCoast vessel transiting the C&D Canal is extremely unlikely to occur and effects are discountable.

The annual number of trips for all vessels (self-propelled and non-self-propelled, all drafts) in the Delaware River Federal Navigation Channel from Trenton to the Sea ranged from 30,853 to 52,032 (median = 41,795) during the period from 2010 through 2019 (ACOE 2020). Non-self-propelled vessels likely pose minimal risk of a vessel strike that could injure or kill a sturgeon. Further, self-propelled vessels such as tugboats transport non-self-propelled vessels and, therefore, the self-propelled vessel and the barges they transport is considered one vessel trip and not two. The annual number of only self-propelled vessel trips ranged from 23,925 to 43,754 (median=33,799) with a total of 339,074 trips over the period from 2010 to 2019. An increase in traffic by even 8 trips in a given year would represent approximately 0.02% of the annual vessel traffic through Delaware Bay, just considering the vessels reported in the waterborne commerce data, which is only a fraction of the total vessel traffic in the Bay. Given this extremely small increase in vessel traffic, it is extremely unlikely that a SouthCoast vessel transiting within Delaware Bay to/from the C&D Canal will increase the risk of a strike of an Atlantic sturgeon and effects are therefore discountable.

Effects of Vessel Transits to the Nexans Facility at the Port of Charleston (SC)
Vessels traveling along the Atlantic coast between the lease area and the Nexans cable facility in the lower portions of the Cooper River will transit past a number of Atlantic sturgeon aggregation areas or "hot spots"; however, these vessels will be transiting in deeper, more offshore waters and not actually pass through any of these areas. As such, the risk to Atlantic sturgeon from the oceanic portions of these trips is the same as identified for the marine environment above; that is, it is extremely unlikely that any Atlantic sturgeon will be struck by project vessels operating in the Atlantic Ocean on the way to/from the Nexans facility.
As explained in Section 2 of this Opinion and above, NMFS completed an ESA section 7 consultation on the construction and use of Nexans facility in Charleston. In the May 4, 2020, Biological Opinion issued to USACE for the construction and operations of the Nexans Cable Facility, NMFS concluded that the construction and use of the Nexans facility was likely to adversely affect but not likely to jeopardize the Carolina DPS of Atlantic sturgeon. However, the only adverse effects to Atlantic sturgeon were dredging and riprap installation. In the Opinion, NMFS concluded that vessel strikes between vessels using the facility to transport cable were extremely unlikely to occur based on the frequency of vessel operations, type of vessel, and low transit speed and that vessels using the facility were not likely to adversely affect any DPS of Atlantic sturgeon. As the effects of this vessel traffic were already considered in the May 2020 Biological Opinion issued for the Nexans Facility, and no take of Atlantic sturgeon by vessel strike was anticipated, and we do not anticipate any difference in the type or level of effects from vessel traffic from those considered in that opinion, SouthCoast Wind's use of the Nexans facility is also extremely unlikely to result in vessel strikes, no take is anticipated: the effects of vessel strike are thus discountable.

Summary of Effects of Vessel Operations on Atlantic Sturgeon
Considering all vessel traffic over the life of the project and the negligible increase over existing annual traffic levels in the riverine/estuarine portions of the vessel transit routes for the project, and the expectation that vessel strike will not occur in the marine portions of the action area, effects to Atlantic sturgeon from project vessel operations are extremely unlikely to occur and are discountable. No take of Atlantic sturgeon by vessel strike is expected to occur as a result of SouthCoast Wind vessels operating in the action area.

7.2.3.2 ESA Listed Whales
Background Information on the Risk of Vessel Strike to ESA Listed Whales
Vessel strikes from a variety of sizes of commercial, recreational, and military vessels have resulted in serious injury and fatalities to ESA listed whales (Laist et al. 2001, Lammers et al. 2003, Douglas et al. 2008, Laggner 2009, Berman-Kowalewski et al. 2010, Calambokidis 2012). Records of collisions date back to the early 17th century, and the worldwide number of collisions appears to have increased steadily during recent decades (Laist et al. 2001, Ritter 2012).

The most vulnerable marine mammals are considered to be those that spend extended periods at the surface feeding or in order to restore oxygen levels within their tissues after deep dives. Mother/calf pairs are at high risk of vessel strike because they frequently rest and nurse in nearshore habitats at or near the water surface, particularly in the Southeast calving area (Cusano et al. 2018; Dombroski et al. 2021). A summary of information on the risk of vessel strike to right whales is found in Garrison et al. 2022. Baleen whales, such as the North Atlantic right whale, seem generally unresponsive to vessel sound, making them more susceptible to vessel collisions (Nowacek et al. 2004). Many studies have been conducted analyzing the impact of vessel strikes on whales; these studies suggest that a greater rate of mortality and serious injury to large whales from vessel strikes correlates with greater vessel speed at the time of a ship strike (Laist et al. 2001, Vanderlaan and Taggart 2007 as cited in Aerts and Richardson 2008). Numerous studies have indicated that slowing the speed of vessels reduces the risk of lethal vessel collisions, particularly in areas where right whales are abundant and vessel traffic is common and otherwise traveling at high speeds (Vanderlaan and Taggart 2007; Conn and Silber 2013; Van der Hoop et al. 2014; Martin et al. 2016; Crum et al. 2019). Vessels transiting at speeds >10 knots present the greatest potential severity of collisions (Jensen and Silber 2004, Silber et al. 2009). Vanderlann and Taggart (2007) demonstrated that between vessel speeds of 8.6 and 15 knots, the probability that a vessel strike is lethal increases from 21% to 79%. In assessing records with known vessel speeds, Laist et al. (2001) found a direct relationship between the occurrence of a whale strike and the speed of the vessel involved in the collision. The authors concluded that most deaths occurred when a vessel was traveling in excess of 24.1 km/h (13 knots). NMFS' data on documented vessel strike events continues to affirm the role of high vessel speeds (> 10 knots (5.1 m/s)) in lethal collision events and supports existing studies implicating speed as a factor in lethal strikes events (87 FR 46921). While it remains unclear how whales generally, and right whales in particular, respond to close approaches by vessels (<460 m) and the extent to which this allows them to avoid being struck, Conn and Silber (2013) indicated that encounter rates were higher with fast-moving vessels than expected, which may be consistent with successful avoidance of slower vessels by whales.

Large whales do not have to be at the water's surface to be struck. In a study that used scale models of a container ship and a right whale in experimental flow tanks designed to characterize the hydrodynamic effects near a moving hull that may cause a whale to be drawn to or repelled from the hull, Silber et al. (2010) found when a whale is below the surface (about one to two times the vessel draft), there is likely to be a pronounced propeller suction effect. This modeling suggests that in certain circumstances, particularly with large, fast moving ships and whales submerged near the ship, this suction effect may draw the whale closer to the propeller, increasing the probability of propeller strikes. Additionally, Kelley et al (2020) found that collisions that create stresses in excess of 0.241 megapascals were likely to cause lethal injuries to large whales and through biophysical modeling that vessels of all sizes can yield stresses higher than this critical level. Growing evidence shows that vessel speed, rather than size, is the greater determining factor in the severity of vessel strikes on large whales; vessels less than 65 ft. in length accounted for 5 of the 12 documented lethal strike events of North Atlantic right whales in U.S. waters since 2008 (87 FR 46921). Of the six lethal vessel strike cases documented in U.S. waters and involving right whales since 1999 where vessel speed is known, only one involved a vessel transiting at under 10 knots (5.1 m/s) (87 FR 46921).

Reducing vessel speed is one of the most effective, feasible options available to reduce the likelihood of lethal outcomes from vessel collisions with right whales (87 FR 46921). In an effort to reduce the likelihood and severity of fatal collisions with right whales, NMFS established vessel speed restrictions in specific locations, primarily at key port entrances, and during certain times of the year, these areas are referred to as Seasonal Management Areas (SMA). A 10-knot speed restriction applies to vessels 65 feet and greater in length operating within any SMA (73 FR 60173, October 10, 2008). As noted above, NMFS has published proposed modifications to these regulations that would increase the scope of the speed restrictions by expanding the geographic area and the size of vessels subject to the speed restrictions (87 FR 46921; August 1, 2022). That regulation has not been finalized and the potential effects of those regulations are not evaluated in this Opinion.

In the 2008 regulations, NMFS also established a DMA program whereby vessels are requested, but not required, to either travel at 10 knots or less or route around locations when certain aggregations of right whales are detected outside SMAs. These temporary protection zones are triggered when three or more whales are visually sighted within 2-3 miles of each other outside of active SMAs. The size of a DMA is larger if more whales are present. A DMA is a rectangular area centered over whale sighting locations and encompasses a 15-nautical mile buffer surrounding the sightings' core area to accommodate the whales' movements over the DMA's 15-day lifespan. The DMA lifespan is extended if three or more whales are sighted within 2-3 miles of each other within its bounds during the second week the DMA is active. Only verified sightings are used to trigger or extend DMAs; however, DMAs can be triggered by a variety of sources, including dedicated surveys, or reports from mariners. Acoustically triggered Slow Zones were implemented in 2020 to complement the visually triggered DMAs. The protocol for the current acoustic platforms that are implemented in the Slow Zone program specify that 3 upcalls must be detected (and verified by an analyst) to consider right whales as "present" or "detected" during a specific time period. Acknowledging that visual data and acoustic data differ, experts from NMFS' right whale Northeast Implementation Team, including NEFSC and Woods Hole Oceanographic Institute staff, developed criteria for accepting detection information from acoustic platforms. To indicate right whale presence acoustically (and be used for triggering notifications), the system must meet the following criteria: (1) evaluation has been published in the peer-reviewed literature, (2) false detection rate is 10% or lower over daily time scales and (3) missed detection rate is 50% or lower over daily time scales. For consistency, acoustically triggered Slow Zones are active for 15 days when right whales are detected and can be extended with additional detections. However, acoustic areas are established by rectangular areas encompassing a circle with a radius of 20 nautical miles around the location of the passive acoustic monitoring system.

In an analytical assessment of when the vessel speed restrictions were and were not in effect, Conn and Silber (2013) estimated the speed restrictions required by the ship strike rule reduced total ship strike mortality by 80 to 90%. In 2020, NMFS published a report evaluating the conservation value and economic and navigational safety impacts of the 2008 North Atlantic right whale vessel speed regulations. The report found that the level of mariner compliance with the speed rule increased to its highest level (81%) during 2018-2019. In most SMAs more than 85% of vessels subject to the rule maintained speeds under 10 knots, but in some portions of SMAs mariner compliance is low, with rates below 25% for the largest commercial vessels outside four ports in the southeast. Evaluations of vessel traffic in active SMAs revealed a reduction in vessel speeds over time, even during periods when SMAs were inactive. An assessment of the voluntary DMA program found limited mariner cooperation that fell well short of levels reached in mandatory SMAs. The report examined AIS-equipped vessel traffic (<65 ft. in length, not subject to the rule) in SMAs, in the four New England SMAs, more than 83% of all <65 ft. vessel traffic transited at 10 knots or less, while in the New York, Delaware Bay, and Chesapeake SMAs, less than 50% of transit distance was below 10 knots. The southern SMAs were more mixed with 55-74% of <65 ft. vessel transit distance at speeds under 10 knots (NMFS 2020). The majority of AIS-equipped <65 ft. vessel traffic in active SMAs came from four vessel types: pleasure, sailing, pilot, and fishing vessels (NMFS 2020).

In the SouthCoast action area, the SouthCoast Wind WDA overlaps with the Block Island SMA; vessels transiting to the WFA from ports in MA, RI, and CT may travel through this SMA, which is in place from November 1 – April 30 each year. Project vessels transiting from ports in Mexico, Texas, and South Carolina may travel through or adjacent to SMAs in the southeast (effective November 15 - April 15 each year) and these vessels plus ones traveling from ports in Maryland may travel through or adjacent to SMAs in the Mid-Atlantic (effective November 1 - April 30 each year). Vessels transiting from Salem, MA would travel near or through the Off Race Point SMA (active March 1 – April 30) and/or the Great South Channel SMA (active April 1 – July 31). Transit through the Cape Cod Bay SMA is not anticipated (active January 1 – May 15).

Many DMAs and acoustically trigged Slow Zones have been established in response to aggregations of right whales in the waters along the U.S. Atlantic coast; as such, we expect these may occur throughout the year in various portions of the action area. For example, in 2023, NMFS declared 70 Slow Zones/DMAs along the U.S. East Coast (NOAA 2023, pers. Comm.). Of these, 31 were triggered by right whale sightings and 39 were triggered by acoustic detections. Slow Zones/DMAs were declared in 9 locations in the Northeast/Mid-Atlantic U.S. (Martha’s Vineyard, MA, Virginia Beach, VA, Portsmouth, NH, Nantucket, MA, Boston, MA, Portland, ME, Ocean City, MD, New York Bight, NY, and Atlantic City, NJ) and in one location in the Southeast U.S. (Outer Banks, NC). As described in the BA (see Appendix A of this Opinion), BOEM will require that SouthCoast Wind vessels of any size travel at speeds of 10 knots or less in any SMA, DMA or Slow Zone triggered by visual and acoustic detections during all project phases.

Exposure Analysis – ESA Listed Whales

We consider vessel strike of ESA listed whales in the context of specific project phases because the characteristics and volume of vessel traffic is distinctly different during the three phases of the project.

Effects of Vessel Transits in the SouthCoast Wind WDA and to/from Ports in southeast MA, RI, and CT

ESA listed whales use portions of the action area throughout the year, including the portion of the action area where vessels will transit in the lease area, along the SouthCoast Wind export cable corridors, and between those locations and identified ports in southeastern MA, RI, and CT (see Section 5 and 6 for more information on distribution of whales in this portion of action area). Baseline vessel traffic in this portion of action area is described at the beginning of this section. Vessel traffic between the ports in southeastern MA, RI, and CT and the WDA accounts for 94% of the anticipated vessel traffic during the construction phase (dependent on the actual ports used), 99% of the anticipated traffic during the operations phase, and 80% of the anticipated traffic during the decommissioning phase. Trips between the WDA and other ports in MA (Salem), MD, SC, and TX, as well as trips within the U.S. EEZ by vessels transiting from Mexico, Canada, Europe, and Asia are addressed following this section.

To assess risk of vessel strike in the area where the majority of vessel traffic will occur (i.e., the WDA and the vessel transits routes south of Cape Cod to ports in southeast MA, RI, and CT) we carried out a four-step process. First, we use the best available information to describe the existing records of vessel strike of right, fin, sei, sperm, and blue whales in that geographic area (i.e., the WDA and the vessel transits routes south of Cape Cod to ports in southeast MA, RI, and CT). Second, we used the best available information on baseline traffic (i.e., the annual number of vessel transits within that geographic area absent the proposed action) and the information provided by BOEM and SouthCoast Wind on the number of anticipated vessel transits in that area by SouthCoast Wind project vessels to determine to what extent vessel traffic would increase in this geographic area during each of the three phases of the SouthCoast Wind project. For example, if baseline traffic was 100 trips per year and the SouthCoast Wind project would result in 10 new trips in that area, we would conclude that traffic was likely to increase by 10%. Third, based on the assumption that risk of vessel strike is related to the amount of vessel traffic (i.e., that more vessels operating in that geographic area would lead to a proportional increase in vessel strike risk), we consider how, absent any avoidance or minimization measures, risk of vessel strike may increase in the area of concern. For example, if we predicted a 10% increase in vessel traffic we would consider that, absent any avoidance or minimization measures, the risk of vessel strike would increase by 10%. It is important to note that these steps were carried out without consideration of any measures designed to reduce vessel strike and the reasonable assumption that all vessels have the same likelihood of striking a whale. Finally, we considered the risk reduction measures that are part of the proposed action and whether, with those risk reduction measures in place, any vessel strike was reasonably certain to occur.

The numbers of baseline vessel transits (from relevant USCG Port Access Route studies, as cited herein) and Project vessel transits (described in BOEM's BA) were used to evaluate the effects of vessel traffic on listed species in the action area as this provides the most accurate representation of vessel traffic in the action area and from the proposed Project. As explained above, baseline vessel transits were estimated from relevant USCG Port Access Route studies (number of trips) which provides a quantifiable comparison and approximation to estimate risk to listed species from the increase in Project vessel traffic. We considered an approach using vessel-miles; however, we have an incomplete baseline of vessel traffic in the region in the terms of vessel miles, as there is significant variability in vessel-mileage between vessel type and activity and no reliable way to obtain vessel miles from the existing baseline data we have access to. While data on the miles that project vessels will travel is partially available, without a robust baseline to compare it to, we are not able to provide an accurate comparison to baseline traffic levels. Additionally, while we can determine the straight line distance between any two points (e.g., New Bedford, MA and any particular point within the WDA), we do not know the exact routes that any vessel will take as that is influenced by weather, sea state, routing around SMAs or DMAs/Slow Zones, and a number of other factors that would make predicting the vessel miles for any individual transit, or all anticipated transits, inexact and unreliable. Further, given that we are considering the area within which the vessels will operate (i.e., evaluating risk along particular vessel routes) we do not expect that the results of our analysis would be any different even if we did have the information necessary to evaluate the increase in vessel traffic in the context of miles traveled rather than number of trips. Based on this foregoing reasoning, using vessel trips results in a more accurate assessment of the risk of adding the SouthCoast Wind vessels to the baseline than could have been carried out using vessel miles and we consider it the best available information for conducting the vessel strike risk analysis.

ESA listed whales use portions of the action area throughout the year, including the portion of the action area where vessels will transit in the SouthCoast Wind WDA and identified ports in in southeast MA, RI, and CT (see Section 5 and 6 for more information on distribution of whales in the action area). Baseline vessel traffic in the action area is described in Section 6. Vessel traffic between the WDA and ports in in southeast MA, RI, and CT accounts for at least for 94% of the anticipated vessel traffic during the construction phase, 99% of the anticipated traffic during the operations phase, and 80% of the anticipated traffic during the decommissioning phase (dependent on the actual ports used).

We reviewed the best available data for the period since the 2008 vessel strike rule was implemented from the marine mammal stock assessment reports and serious injury and mortality reports produced by NMFS, for the period of 2011-2021 (Henry et al. 2015 for 2009-2010 data, Henry et al. 2017 for 2011-2015 data, Henry et al. 2022 from 2016-2020 data, Henry et al. 2023 for 2012-2021 data; these are the most recent reports available). From these reports, we did not identify any records of mortality of ESA listed whales consistent with vessel strike that were first detected in waters of southern New England (MA, RI, CT - south of Cape Cod) which is the best representation of the geographic area representing the SouthCoast Wind WDA, and the area where vessels will transit between these areas and the identified ports in southeastern MA, RI, and CT. In 2010, there was one fin whale (calf) first observed 24.3 nm E of Montauk with two healed propeller scars; given that these injuries were healed we do not consider this as a report of a vessel strike in the geographic area considered here (Henry et al. 2015). As noted above, the waters between the WDA and ports in southeast MA, RI, and CT accounts for a large proportion of all of the vessel traffic associated with the SouthCoast Wind project. We also reviewed NMFS records post-dating 2020, including information from the North Atlantic right whale UME (as posted through October 20, 2024), and did not identify any records of vessel strikes in this area. However, we note that multiple vessel strikes of sei, fin and right whales have occurred since 2008 in waters outside the geographic area considered here (Hayes et al. 2022, Henry et al. 2017, Henry et al. 2022, Henry et al. 2023).[45] Additionally, we note that the location of where a vessel strike occurs is not always known and the location the animal is first documented may not be the location where the strike occurred. For example, a time series of observed annual total mortality and serious injury of North Atlantic right whales versus estimated total mortalities is included in the 2020 North Atlantic right whale Stock Assessment Report (see Figure 5 in Hayes 2021). Additionally, depending on cetacean species, carcasses may be more likely to float or sink, they may be carried from where they were struck on the bow

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[45] https://www.fisheries.noaa.gov/s3/2024-10/North-Atlantic-Right-Whale-Causes-of-Death-for-Confirmed-Carcasses-SI-and-Morbidity-Tables-Combined_30Sep2024_revised.pdf; last accessed 10/20/2024

of a vessel and only noticed in port, or carried away from the ship strike location by wind, currents, and waves. All of these factors contribute to the difficulty in detecting carcasses, in particular from ship strike (Rockwood et al. 2017).

A number of studies have estimated carcass recovery rates for different cetacean species, including 17% for right whales, 6.5% for killer whales, <5% for grey whales, and 3.4% for sperm whales (Kraus et al. 2005). Pace et al. (2021) used an abundance estimation model to derive estimates of cryptic mortality for North Atlantic right whales and found that observed carcasses accounted for 36% of all estimated deaths during 1990–2017 (Pace et al. 2021). Given these factors, it is difficult to identify a number of strikes of any of these species that has occurred in the geographic area of interest since 2008.

Absent any mitigation measures, we would generally expect an increase in risk proportional to the increase in vessel traffic. As such, this would increase annual risk during the construction period by up to 2.94%, during the operations and maintenance period by up to 2.05%, and by up to 2.50% during the decommissioning period (Table 7.2.3). As noted above, no records of ESA listed whales with injuries consistent with vessel strike that were first documented in the area of interest were found in the serious injury and mortality reports produced by NMFS since 2008. In the portions of this area that overlap with high areas of vessel traffic (i.e., the existing SMAs) risk of vessel strike, particularly for right whales, is generally considered higher than in other areas with lower levels of vessel traffic. Blue, sei, and sperm whales are typically found in deeper waters of the continental shelf, and are expected to be rarer in the SouthCoast Wind WDA and in the coastal portions of the action area where vessels will transit between most ports and the SouthCoast Wind WDA.

There are a number of factors that result in us determining that any potential increase in vessel strike is extremely unlikely to occur. As described above in Section 7.2.2, a number of measures designed to reduce the likelihood of striking marine mammals including ESA listed large whales, particularly North Atlantic right whales, are included as part of the proposed action. These measures include seasonal speed restrictions in areas and at times of year when risk of strike is considered highest, monitoring via trained lookouts (equipped with alternative monitoring technologies for low light conditions) and situational awareness communication systems, PAM, and vessel separation distances.

The vessel speed limit requirements proposed by BOEM and NMFS OPR are in accordance with measures outlined in NMFS Ship Strike Reduction Strategy as the best available means of reducing ship strikes of right whales and are consistent with the changes proposed to vessel size in the recent proposed rule; that is, they limit speed to 10 knots or less for all vessels in areas and times when right whales are most likely to occur. As described above and in Appendices A and B of this Opinion, specific measures related to vessel speed reduction will be in place for vessels, regardless of size, transiting in SMAs whenever active, DMAs/Slow Zones year round, and for all vessels, regardless of size operating within the lease area or to/from the lease area from November 1- April 30. Outside of this period and when no other speed restrictions are in place, if a vessel is traveling at any speed greater than 10 knots (i.e., no speed restrictions are enacted) in a transit corridor (defined as a specific route from a port to the Lease Area or return), in addition to the required dedicated visual observer, SouthCoast Wind must monitor the transit corridor in real-time with PAM prior to and during transits. The only exceptions to these speed restrictions are in health and safety emergencies. Year round, all underway vessels will have a dedicated trained lookout to monitor for protected species. Lookouts will be equipped with technology to improve visibility/detection in low light conditions.

Most ship strikes have occurred at vessel speeds of 13-15 knots or greater (Jensen and Silber 2004, Laist et al. 2001). An analysis by Vanderlaan and Taggart (2007) showed that at speeds greater than 15 knots, the probability of a ship strike resulting in death increases asymptotically to 100%. At speeds below 11.8 knots, the probability decreases to less than 50%, and at ten knots or less, the probability is further reduced to approximately 30%. In rulemaking, NMFS has concluded, based on the best available scientific evidence, that a maximum speed of 10 knots, as measured as "speed over ground," in certain times and locations, is the most effective and practical approach to reducing the threat of ship strikes to right whales. Absent any information to the contrary, we assume that a 10-knot speed restriction similarly reduces the risk to other whale species. Substantial evidence (Laist et al., 2001; Jensen and Silber, 2004; Vanderlaan and Taggart, 2007; Kelley et al. 2020) indicates that vessel speed is an important factor affecting the likelihood and lethality of whale/vessel collisions. In a compilation of ship strikes of all large whale species that assessed ship speed as a factor in ship strikes, Laist et al. (2001) concluded that a direct relationship existed between the occurrence of a whale strike and the speed of the vessel. These authors indicated that most deaths occurred when a vessel was traveling at speeds of 14 knots or greater and that, as speeds declined below 14 knots, whales apparently had a greater opportunity to avoid oncoming vessels. Adding to the Laist et al. (2001) study, Jensen and Silber (2004) compiled 292 records of known or probable ship strikes of all large whale species from 1975 to 2002. Vessel speed at the time of the collision was reported for 58 of those cases; 85.5 percent of these strikes occurred at vessel speeds of 10 knots or greater. Effects of vessel speed on collision risks also have been studied using computer simulation models to assess hydrodynamic forces vessels have on a large whale (Knowlton et al., 1995; Knowlton et al., 1998). These studies found that, in certain instances, hydrodynamic forces around a vessel could act to pull a whale toward a ship. These forces increase with increasing speed and thus a whale's ability to avoid a ship in close quarters may be reduced with increasing vessel speed. Related studies by Clyne (1999) found that the number of simulated strikes with passing ships decreased with increasing vessel speeds, but that the number of strikes that occurred in the bow region increased with increasing vessel speeds. Additionally, vessel size has been shown to be less of a significant factor than speed, as biophysical modeling has demonstrated that vessels of all sizes can yield stresses likely to cause lethal injuries to large whales (Kelley et al. 2020). The speed reduction alone provides a significant reduction in risk of vessel strike as it both provides for greater opportunity for a whale to evade the vessel but also ensures that vessels are operating at such a speed that they can make evasive maneuvers in time to avoid a collision.

A number of measures will be in place to maximize the likelihood that any whales along the vessel transit route are detected in sufficient time to allow for notification of the vessel operator and for measures to be taken to avoid a strike (such as slowing down and/or altering course). Although some of these measures have been developed to specifically reduce risk of vessel strike with right whales, all of these measures are expected to provide the same protection for other large whales as well. These measures apply regardless of the length of the vessel and include dedicated trained lookouts on all Project vessels during all phases to monitor the vessel strike avoidance zone and requirements to slow down less than 10 knots if a whale is spotted, use of alternative monitoring technology (such as night vision) to improve detectability of large whales in low visibility conditions, and additional measures as outlined in the proposed MMPA ITA and BA. These measures are meant to increase earlier detection of whale presence and subsequently further increase time available to avoid a strike. Awareness of right whales in the area will also be enhanced through monitoring of reports on situational awareness communication systems such as USCG Channel 16, communication between project vessel operators of any sightings, and monitoring of WhaleAlert.

Here, we explain how these measures support our determination that any potential increase in vessel strike due to increases in vessel transit caused by the proposed action is extremely unlikely to occur. Many of these measures are centered on vessel speed restrictions and increased monitoring. To avoid a vessel strike, a vessel operator both needs to be able to detect a whale and be able to slow down or move out of the way in time to avoid collision; alternatively, the animal needs to detect the vessel and move out of the way of the vessel. The speed limits and monitoring measures that are part of the proposed action maximize the potential for effective detection and avoidance.

Vessel speed restrictions:

As explained above, a 10 knot speed restriction will be in place for all project vessels from November 1 to April 30 operating anywhere in the action area for all project phases. The only exceptions are health and safety emergencies (i.e., there is a threat to human life or safety, such as a medical emergency on board that necessitates quick access to emergency medical services on shore). The November - April period is the time of year when North Atlantic right whales are most likely to occur in the area with the highest anticipated project vessel traffic considered in this Opinion and covers the months when density is highest around the WDA and regional waters. Outside of the November – April, vessels can travel greater than 10 knots only if they are traveling in a transit corridor monitored by real-time PAM in accordance with a plan reviewed by and concurred with by NMFS. Vessels of all sizes will also comply with a 10 knot speed limit in any SMA, DMA, and Slow Zone. For all project phases, year round, all underway vessels will have a dedicated trained lookout to monitor for protected species and implement mitigation measures as necessary. Vessels would also be required to slow to 10 knots or less any time a large whale (of any species) is observed within 500 m of a vessel. All vessels, regardless of size, would immediately reduce speed to 10 knots or less when a North Atlantic right whale is sighted, at any distance, by a lookout or anyone else on the vessel.

By reducing speeds below 10 knots, the probability of a lethal ship strike is greatly reduced; additionally, reduced speeds provide greater time to react if a dedicated visual observer observes an animal in the path of a vessel and therefore reduces the likelihood of any strike occurring at all. Some project vessels are expected to never, or rarely, operate at speeds over 10 knots including during HRG survey activities, cable laying, and survey vessels trawling or hauling gear, these vessels are expected to normally operate at speeds less than 5 knots. Vessel speed restrictions are summarized above and are designed to limit vessel speeds during times of year and in locations when right whales are most likely to occur.

The period of time and areas when vessels can travel at speeds greater than 10 knots are at times when North Atlantic right whales are expected to occur in very low numbers and thus the risk of a vessel strike is significantly lower. As noted above, if vessels are operating great than 10 knots during this time period, PAM will be used to monitor for the presence of vocalizing whales in a defined transit corridor. Travel above 10 knots will only occur in "transit corridors" with PAM which decreases the potential for a vessel traveling greater than 10 knots to co-occur with a right whale. If a North Atlantic right whale is detected via visual observation or PAM within or approaching the transit corridor, all vessels must travel at 10 knots or less for the following 24 hours. Each subsequent detection will trigger a 24-hour reset. A slowdown in the transit corridor expires when there has been no further visual or acoustic detection of North Atlantic right whales in the transit corridor in the past 24 hours. This increases detectability beyond the area that an observer can see and enhances the effectiveness of required vessel avoidance measures. In all instances, trained lookouts will be monitoring a vessel strike zone, see below.

Dedicated Trained Lookouts and Increased right whale awareness:

A number of measures will be required by BOEM and/or NMFS OPR to increase awareness and detectability of whales. Vessel operators and crews will receive protected species identification training that covers species identification as well as making observations in good and bad weather. All vessel operators and crews must maintain a vigilant watch for all marine mammals and slow down, stop their vessel, or alter course (as appropriate) and regardless of vessel size, to avoid striking any marine mammal, including ESA listed whale species. During all vessel transits, a dedicated trained lookout would be stationed at the best vantage point of the vessel(s) to ensure that the vessel(s) are maintaining the appropriate separation distance from protected species. A dedicated trained lookout must be posted during all times a vessel is underway (transiting or surveying) to monitor for listed species and would have no other responsibilities. If a whale is sighted, the lookout will communicate to the vessel operator to slow down and take measures to avoid the sighted animal. Trained lookouts will also be equipped with alternative monitoring technology for periods of low visibility (e.g., darkness, rain, fog, etc.). At all times the lookout will be monitoring for presence of whales and ensuring that the vessel stays at least 500 meters away from any right whale or unidentified large whale. If any whale is detected within 500 meters of the vessel, avoidance measures will be implemented and vessel speed will be reduced to less than 10 knots; if any right whale is observed within any distance from the vessel, avoidance measures will be taken and vessel speed will be reduced to less than 10 knots.

Year-round, in addition to the seasonal speed restrictions, required dedicated trained lookout and real-time PAM, all vessel operators will monitor situational awareness communication systems, such as WhaleAlert, US Coast Guard VHF Channel 16, and project communication channels for the presence of North Atlantic right whales. The trained lookout and PAM operator monitoring teams for all activities will also monitor these systems no less than every 12 hours. If a vessel operator is alerted to a North Atlantic right whale detection, they will immediately convey this information to the trained lookout. Prior to and while underway, all vessel operators must check for information regarding mandatory or voluntary ship strike avoidance (Slow Zones/DMAs and SMAs) and daily information regarding right whale sighting locations. Active monitoring of right whale sightings information provides situational awareness for monitoring of right whales in the area of vessel activities.

In summary, we expect that despite the increase in vessel traffic that will result from the proposed action, the multi-faceted measures that will be required of all Project vessels will likely enable the detection of any ESA listed whale that may be in the path of a Project vessel with enough time to allow for vessel operators to avoid any such whales.

Given the more offshore distribution of sei, blue, and sperm whales and the relatively low density of these species where project vessels will primarily transit, we expect that the potential for co-occurrence of an individual of one of these species with a SouthCoast Wind vessel operating in this area is extremely unlikely. The required minimization measures outlined above provide increased risk reduction when vessels are transiting in waters where these species may occur. As such, effects to sei, blue, and sperm whales from the operation of SouthCoast Wind vessels are discountable.

Project vessel traffic will primarily be traveling northwest/southeast to/from regional ports in southern New England to the WDA, southwest/northeast to/from Mid-Atlantic and Gulf of Mexico ports to the WDA, and east and west to/from foreign ports to the WDA, these directions are primarily away from the areas of high predicted density of North Atlantic right whales. Additionally, seasonal construction restrictions limit activities during times of year when right whale density is highest and thus will reduce vessel traffic as well. Combined with the already low increased risk of vessel strike anticipated due to increased project vessel traffic, we expect that the measures that are specifically designed to reduce risk of project vessels striking a right whale will further reduce that risk and make it extremely unlikely that a Project vessel will strike a right whale. Therefore, effects to right whales from the operation of SouthCoast Wind vessels are discountable.

As described above, given the primarily nearshore areas where Project vessels will be transiting and relatively lower predicted density, there is a low likelihood for co-occurrence between project vessels and fin whales. Additionally, considering the available data from 2008 through 2021 (as cited above) there were no reports of vessel strikes of fin whales in the area where the highest amounts of project vessel traffic will occur. Combined with the already low increased risk of vessel strike anticipated due to increased project vessel traffic, we expect that the measures that are designed to reduce risk of project vessels striking fin whales will effectively reduce that risk further and make it extremely unlikely that a Project vessel will strike a fin whale. Therefore, effects to fin whales from the operation of SouthCoast Wind vessels are discountable.

Effects of Vessel Transits to/from Ports in Salem, MA and the SouthCoast Wind WDA
During the construction phase, SouthCoast Wind anticipates up to 15 vessel trips between the WDA and ports in Salem, MA. During the operational phase, up to 117 vessel trips are anticipated and during decommissioning, up to 618 vessel trips are anticipated. These vessels would include heavy transport vessels, heavy installation vessels, guard/scout vessels, pre-lay grapnel run vessels, supply barges, survey vessels, anchor handling tugs, cable lay barges, cable transport vessels, dredging vessels, and support vessels. Vessels transiting between Salem, MA and the SouthCoast Wind WDA are expected to travel in the Boston traffic separation scheme outside of Cape Cod and then transit to the lease area. The traffic separation schemes were re-routed in 2007 into an area of lesser whale density, with little change in travel time. The move

reduced the risk of ship strike for right whales by 58%, and 81% for all baleen whale species (SBNMS).

As described in Section 6 of this Opinion, ESA listed whales occur in this area in varying distributions and abundances throughout the year, and North Atlantic right whale critical habitat is located in this area. North Atlantic right whales occur in the area year round, most notably around Nantucket Shoals. Based on detections from aerial surveys and PAM deployments within the RI/MA WEA, right whales are expected in the WDA in higher numbers in winter and spring followed by decreasing abundance into summer and early fall. Fin whales most commonly occur throughout the year in offshore waters of the northern Mid-Atlantic. Sei whales typically are found offshore along the shelf break typically in northern Mid-Atlantic waters, primarily during the fall, winter, and spring. Sperm whales along the Mid-Atlantic are found offshore along the shelf break year-round. Blue whales are typically found further offshore in areas with depths of 100 m or more. In general, ESA listed whales are expected to be highly dispersed in deeper offshore waters and, given the large area over which Project vessels could potentially transit, the likelihood of co-occurrence is low in offshore waters.

Project vessels will represent a small portion (up to 15 total trips over the construction period, 117 trips during operations, and 618 trips during decommissioning) of the vessel traffic traveling in the area between Salem, MA and the SouthCoast Wind WDA. Information from the USCG's 2023 Port Access Route Study: Approaches to Maine, New Hampshire, and Massachusetts MA indicates that there are thousands of vessel transits per year in this area. Given the expected duration of each phase, this results in relatively few vessels trips per year, this will be a very small increase in traffic in this area. Considering just the vessel transits in the identified cross sections between Salem and Boston (Coastwise, Between Boston Harbor and Gloucester; North of Boston Harbor TSS, and TSS, Boston Harbor), there were an average of 3,206 vessel tracks annually between 2019 and 2021 (USCG 2023, Enclosure 1). During decommissioning when vessel traffic to/from Salem and the WDA is anticipated to be highest, there will be an average of 125 trips per year, this will be a very small increase in traffic in this area (less than 4%, noting that not all vessel transits are recorded in the USCG PARS). Given that with few exceptions, these vessels will be traveling at speeds of 10 knots or less year-round and will be in compliance with vessel strike regulations, and have trained lookouts monitoring for whales, and in consideration of the extremely small increase in vessel traffic in this portion of the action area that these vessels will represent, it is extremely unlikely that any ESA listed whales will be struck by a project vessel operating in this portion of the action area. Therefore, effects to right, fin, sei, blue, and sperm whales from vessel strike due to project vessels operating in this portion of the action area are discountable.

Effects of Vessel Transits to/from Ports in the Chesapeake Bay (Baltimore - Sparrows Point, MD) and the Nexans Facility at the Port of Charleston (SC)

During the construction phase, SouthCoast Wind anticipates up to eight vessel trips each between Sparrows Point Port, MD and the SouthCoast WDA and between the Nexans Facility at the Port of Charleston, SC and the SouthCoast WDA. During the operational phase, two vessel trips each between Sparrows Point Port, MD and the SouthCoast WDA and between the Nexans Facility at the Port of Charleston, SC and the SouthCoast WDA are estimated. No vessel transits are expected to these ports during decommissioning. These vessels would be cable lay barges and cable transport vessels, and may transit up to 15 knots except when subject to vessel speed restrictions that would limit speeds to up to 10 knots. Vessels transiting between these ports and the SouthCoast Wind WDA are expected to travel in shipping lanes when entering/leaving port and then transit offshore along the same routes as commercial vessels.

As described in Section 6 of this Opinion, ESA listed whales occur in this area in varying distributions and abundances throughout the year. North Atlantic right whales occur in the area primarily in the fall and early spring, as some individuals in the population travel through the Mid-Atlantic to the Southeast calving grounds while other portions of the population may forage in the Mid-Atlantic. Fin whales most commonly occur throughout the year in offshore waters of the northern Mid-Atlantic. Sei whales typically are found offshore along the shelf break typically in northern Mid-Atlantic waters, primarily during the fall, winter, and spring. Sperm whales along the Mid-Atlantic are found offshore along the shelf break year-round. Blue whales are typically found further offshore in areas with depths of 100 m or more. In general, ESA listed whales are expected to be highly dispersed in deeper offshore waters and, given the large area over which Project vessels could potentially transit, the likelihood of co-occurrence is low in offshore waters.

Project vessels will represent an extremely small portion - up to 8 vessel trips each between Sparrows Point Port, MD and the SouthCoast WDA and between the Nexans Facility at the Port of Charleston, SC and the SouthCoast WDA during the during the construction phase, two vessel trips each between Sparrows Point Port, MD and the SouthCoast WDA and between the Nexans Facility at the Port of Charleston, SC and the SouthCoast WDA during the operational phase, and no vessel transits are expected to these ports during decommissioning - of the vessel traffic traveling through Mid-Atlantic waters to/from the SouthCoast Wind WDA. Considering, an estimated 74,000 vessel transits a year occur in the Mid-Atlantic area, this is an approximately 0.02% increase in traffic in this area, assuming that all of these trips represent “new” trips for vessels that otherwise would not be operating in this area and all 16 trips during the construction phase occur in one year. Given this extremely small increase in vessel traffic, any increased risk of vessel strike of sea turtles is also extremely small. During operations, only two trips to each port are expected, thus this risk is even lower. Given that with few exceptions, these vessels will be traveling at speeds of 10 knots or less year-round and will be in compliance with vessel strike regulations, and have trained lookouts monitoring for whales, and in consideration of the extremely small increase in vessel traffic in this portion of the action area that these vessels will represent, it is extremely unlikely that any ESA listed whales will be struck by a project vessel operating in this portion of the action area. Therefore, effects to right, fin, sei, blue, and sperm whales from vessel strike due to project vessels operating in this portion of the action area are discountable.

Effects of Vessel Transits in the U.S. EEZ South, East, and North of the SouthCoast Wind WDA
Due to project component and vessel availability, vessels will transit from ports in eastern Canada, Europe and Asia to the SouthCoast Wind WDA; this section considers vessel transits through the U.S. EEZ. These vessels will be heavy transport vessels, cable transport vessels, dredging vessels, and scour protection vessels during transit these vessels may travel up to 15 knots when not subject to vessel speed restrictions that would limit speed to 10 knots. BOEM has indicated that during the entire five to seven-year construction period there may be up to 64

vessel transits from ports in Europe/Asia to the U.S., up to 109 trips expected to travel from ports in eastern Canada, and up to 3 trips expected for vessels traveling through the Panama Canal before traveling to the WDA or local ports in the U.S. During the operational phase, there may be up to 37 vessel transits from ports in Europe/Asia to the U.S., up to 21 trips expected to travel from ports in eastern Canada, and no trips expected for vessels traveling through the Panama Canal before traveling to the WDA or local ports in the U.S. During the decommissioning phase, there may be up to 55 vessel transits from ports in Europe/Asia to the U.S., up to 55 trips expected to travel from ports in eastern Canada, and up to 7 trips expected for vessels traveling through the Panama Canal before traveling to the WDA or local ports in the U.S. Project vessels will represent an extremely small portion of the vessel traffic traveling through the EEZ during this period of time. In this portion of the action area, co-occurrence of project vessels and individual whales is expected to be extremely unlikely; this is due to the dispersed nature of whales in the open ocean and the only intermittent presence of project vessels. When operating outside of an active SMA or Slow Zone/DMA, these vessels could operate at speeds over 10 knots; however, they will have a dedicated lookout monitoring for whales and will be required to slow down (to 10 knots or less), stop their vessel, or alter course (as appropriate) to avoid getting within 500 m of any whale. Given the limited amount of vessel trips in this area (i.e., up to 176 trips over a five to seven-year period), the dispersed nature of whales in this offshore area, and the limited potential for co-occurrence of a whale and one of these vessels, it is extremely unlikely that any ESA listed whales will be struck by a project vessel during one of the no more than 176 transits within the U.S. EEZ on its way to or from ports in eastern Canada, Europe, and Asia. The requirements for lookouts and to slow down if whales are observed would further decrease this risk. Therefore, effects to right, fin, sei, blue, and sperm whales from vessel strike due to project vessels operating in this portion of the action area are discountable.

Effects of Vessel Transits to/from Ports in the Gulf of Mexico and the SouthCoast Wind WDA
During the five to seven-year construction phase, SouthCoast Wind anticipates up to 71 vessel trips between two ports in the Gulf of Mexico (Corpus Christi, TX and Altamira, Mexico), no trips during the operational phase, and only 9 trips from the port of Corpus Christi, TX during the decommissioning phase. These vessels would include heavy transport vessels, supply barges, and tugboats and may transit up to 16 knots when not subject to vessel speed restrictions. Vessels transiting between these ports and the SouthCoast Wind WDA are expected to travel in shipping lanes when entering/leaving port and then transit offshore along the same routes as commercial vessels around Florida and then along the U.S. East Coast. Vessels transiting between these ports and the SouthCoast Wind WDA are expected to travel in shipping lanes when entering/leaving port and then transit offshore along typical commercial vessel routes around Florida and then along the U.S. East Coast. These vessels will travel at speeds of less than 10 knots in any SMAs or Slow Zones/DMAs that their transit routes overlap with. They will also have a trained lookout to monitor for whales and to communicate with the vessel captain and will be required to slow down if whales are sighted (as described above).

As described in Section 6, ESA listed whales occur in this area and along the U.S. South Atlantic in varying distribution and abundance throughout the year. North Atlantic right whales are not expected to occur in the Gulf of Mexico. They occur in coastal waters of the South Atlantic primarily in the fall through early spring; during this time, SMAs overlap with portions of high vessel activity (i.e., November 1 - April 30, multiple Mid-Atlantic SMAs, and November 15 -

April 15, calving and nursery grounds SMA). Fin whales are not expected to occur in the Gulf of Mexico and are not common in the South Atlantic, they may be present in small numbers in offshore waters along the shelf break, further offshore than where the vessels will transit. Sei whales are not expected to occur in the Gulf of Mexico and are uncommon in the South Atlantic. Sperm whales may be found in deep offshore waters in the Gulf of Mexico and along the South Atlantic are found offshore along the shelf break year-round. Blue whales are not expected to occur in the Gulf of Mexico and are uncommon in the South Atlantic. In general, ESA listed whales are expected to be highly dispersed in deeper offshore waters and, given the large area over which Project vessels could potentially transit, the likelihood of co-occurrence is low in offshore waters.

Project vessels will represent an extremely small portion (up to 71 trips over five-year construction period) of the vessel traffic traveling through the Gulf of Mexico and South Atlantic waters to/from the SouthCoast Wind WDA. Given the number of major ports along the South Atlantic and Gulf of Mexico, baseline vessel traffic is expected to be similar to, or higher than, waters of the Mid-Atlantic (approximately 74,000 vessel transits a year). Considering, an estimated 74,000 vessel transits a year occur in the Mid-Atlantic area, this is about an 0.01% increase in traffic in this area, assuming that all of these trips represent "new" trips for vessels that otherwise would not be operating in this area and all 71 trips during the construction phase occur in one year. Given that these vessels will be in compliance with vessel strike regulations, including traveling at speeds of 10 knots or less in any SMA or Slow Zone/DMA that overlap their transit routes, and have trained lookouts monitoring for whales, and in consideration of the extremely small increase in vessel traffic in this portion of the action area that these vessels will represent, it is extremely unlikely that any ESA listed whales will be struck by a project vessel operating in this portion of the action area. Therefore, effects to right, fin, sei, blue, and sperm whales from vessel strike due to project vessels operating in this portion of the action area are discountable.

Summary of Effects of Vessel Traffic on ESA Listed Whales
In summary, while there is an increase in risk of vessel strike during all phases of the proposed project due to the increase in vessel traffic, because of the measures that will be in place, particularly the vessel speed restrictions and use of enhanced monitoring measures, we do not expect that this increase in risk will result in a vessel strike caused by the action. Based on the best available information on the risk factors associated with vessel strikes of large whales (i.e., vessel size and vessel speed), and the measures required to reduce risk, it is extremely unlikely that any project vessel will strike a right, fin, sei, blue, or sperm whale during any phase of the proposed project. Therefore, effects to right, fin, sei, blue, and sperm whales from vessel strike due to project vessels operating in the action area are discountable.

7.2.3.3 Sea Turtles

Background Information on the Risk of Vessel Strike to Sea Turtles
While research is limited on the relationship between sea turtles, ship collisions, and ship speeds, sea turtles are at risk of vessel strike where they co-occur with vessels. Sea turtles are vulnerable to vessel collisions because they regularly surface to breathe, and often rest at or near the surface. Sea turtles, with the exception of hatchlings and pre-recruitment juveniles, spend a majority of their time submerged (Renaud and Carpenter 1994; Sasso and Witzell 2006). Although, Hazel et

al. (2007) demonstrated sea turtles preferred to stay within the three meters of the water's surface, despite deeper water being available. Any of the sea turtle species found in the action area can occur at or near the surface in open-ocean and coastal areas, whether resting, feeding or periodically surfacing to breathe. Therefore, all ESA listed sea turtles considered in the biological opinion are at risk of vessel strikes.

A sea turtle's detection of a vessel is likely based primarily on the animal's ability to see the oncoming vessel, which would provide less time to react to as vessel speed increases (Hazel et al. 2007), however, given the low vantage point of a sea turtle at the surface it is unlikely they are readily able to visually detect vessels at a distance. Hazel et al. (2007) examined vessel strike risk to green sea turtles and suggested that sea turtles may habituate to vessel sound and are more likely to respond to the sight of a vessel rather than the sound of a vessel, although both may play a role in eliciting responses (Hazel et al. 2007). Regardless of what specific stressor associated with vessels turtles are responding to, they only appear to show responses (avoidance behavior) at approximately 10 m or closer (Hazel et al. 2007). This is a concern because faster vessel speeds also have the potential to result in more serious injuries (Work et al. 2010). Although sea turtles can move quickly, Hazel et al. (2007) concluded that at vessel speeds above 4 km/hour (2.1 knots) vessel operators cannot rely on turtles to actively avoid being struck. Thus, sea turtles are not considered reliably capable of moving out of the way of vessels moving at speeds greater than 2.1 knots.

Stranding networks that keep track of sea turtles that wash up dead or injured have consistently recorded vessel propeller strikes, skeg strikes, and blunt force trauma as a cause or possible cause of death (Chaloupka et al. 2008). Vessel strikes can cause permanent injury or death from bleeding or other trauma, paralysis and subsequent drowning, infection, or inability to feed. Apart from the severity of the physical strike, the likelihood and rate of a turtle's recovery from a strike may be influenced by its age, reproductive state, and general condition at the time of injury. Much of what has been documented about recovery from vessel strikes on sea turtles has been inferred from observation of individual animals for some duration of time after a strike occurs (Hazel et al. 2007; Lutcavage et al. 1997). In the U.S., the percentage of strandings that were attributed to vessel strikes increased from approximately 10 percent in the 1980s to a record high of 20.5 percent in 2004 (USFWS 2007). In 1990, the National Research Council estimated that 50-500 loggerhead and 5-50 Kemp's ridley sea turtles were struck and killed by boats annually in waters of the U.S. (NRC 1990). The report indicates that this estimate is highly uncertain and could be a large overestimate or underestimate.

Vessel strike has been identified as a threat in recovery plans prepared for all sea turtle species in the action area. As described in the Recovery Plan for loggerhead sea turtles (NMFS and USFWS 2008), propeller and collision injuries from boats and ships are common in sea turtles. From 1997 to 2005, 14.9% of all stranded loggerheads in the U.S. Atlantic and Gulf of Mexico were documented as having sustained some type of propeller or collision injuries although it is not known what proportion of these injuries were post or ante-mortem. The proportion of vessel-struck sea turtles that survive is unknown. In some cases, it is not possible to determine whether documented injuries on stranded animals resulted in death or were post-mortem injuries. However, the available data indicate that post-mortem vessel strike injuries are uncommon in stranded sea turtles. Based on data from off the coast of Florida, there is good evidence that when vessel strike injuries are observed as the principle finding for a stranded turtle, the injuries were both ante-mortem and the cause of death (Foley et al 2019). Foley et al. (2019) found that the cause of death was vessel strike or probable vessel strike in approximately 93% of stranded turtles with vessel strike injuries. Sea turtles found alive with concussive or propeller injuries are frequently brought to rehabilitation facilities; some are later released and others are deemed unfit to return to the wild and remain in captivity. Sea turtles in the wild have been documented with healed injuries so at least some sea turtles survive without human intervention. As noted in NRC 1990, the regions of greatest concern for vessel strike are outside the action area and include areas with high concentrations of recreational-boat traffic such as the eastern Florida coast, the Florida Keys, and the shallow coastal bays in the Gulf of Mexico. In general, the overall risk of strike for sea turtles in the Northwest Atlantic is considered greatest in areas with high densities of sea turtles and small, fast moving vessels such as recreational vessels (NRC 1990). This combination of factors in the action area is limited to nearshore areas in the southern extent of the action area, well outside the SouthCoast Wind WFA and the transit routes to ports in southern New England where the vast majority of vessel traffic will occur.

Exposure Analysis – Sea Turtles

We consider vessel strike of ESA listed sea turtles in the context of specific project phases because the characteristics and volume of vessel traffic is distinctly different during the three phases of the project.

Effects of Vessel Transits in the SouthCoast Wind WDA and to/from Ports in southeast MA, RI, and CT

Here we consider the risk of vessel strike to sea turtles from project vessels transiting between the SouthCoast Wind WDA (lease area and cable corridors) and the identified ports in southeast MA, RI, and CT. Trips between the WDA and Salem, MA, Sparrows Point, MD, Charleston, SC as well as trips within the US EEZ by vessels transiting from Canada, Asia, Mexico and Europe are addressed following this section.

To inform our consideration of the baseline vessel strikes of sea turtles in this area, we carried a query of the NMFS' Sea Turtle Stranding and Salvage Network (STSSN) database for records of sea turtles with injuries consistent with vessel strike (recorded as definitive vessel and blunt force trauma in the database). The queried area includes the ports in New England where the majority of SouthCoast Wind vessel traffic will travel to and from, the anticipated vessel transit routes to and from these ports to the lease area, the lease area, and an expanded buffer to account for carcass drift. The results from this query are presented in Table 7.2.4.

While we recognize that some vessel strikes may be post-mortem, the available data indicate that post-mortem vessel strike injuries are uncommon in stranded sea turtles (Foley et al. 2019). Based on the findings of Foley et al. (2019) that found vessel strike was the cause of death in 93% of strandings with indications of vessel strike, we consider that 93% of the sea turtle strandings recorded as "definitive vessel" and "blunt force trauma" had a cause of death attributable to vessel strike. Therefore, to estimate the number of interactions where vessel strike was the cause of death we first added the number of "definitive vessel" and "blunt force trauma" cases to get a total number of sea turtle strandings with indications of vessel strike, and then calculated 93% of the total (e.g., for Table 7.2.4, for loggerheads, we first added the "definitive vessel" (25) and "blunt force trauma" (9) then multiplied that value (34) by 0.93 (=33.37)). The result is the number of turtles in the "total presumed vessel mortalities" column in Table 7.2.4.

Table 7.2.4. Preliminary STSSN cases from 2014 to 2023 with Evidence of Propeller Strike or Probable Vessel Collision in the Southern New England Region and Estimated Presumed Vessel Mortalities.

Sea Turtles	Total Records	Definitive Vessel	Blunt Force Trauma	Total Presumed Vessel Mortalities*
NWA DPS Loggerhead sea turtle	99	25	9	33.37
NA DPS Green sea turtle	5	1	2	2.79
Leatherback sea turtle	102	31	4	32.55
Kemp's ridley sea turtle	14	3	0	2.79

Source: STSSN (October, 2024)
* 93% of the total of "definitive vessel" plus "blunt force trauma"

The data in Table 7.2.4 and 7.2.5 reflect stranding records, which represent only a portion of the total at-sea mortalities of sea turtles. Sea turtle carcasses typically sink upon death, and float to the surface only when enough accumulation of decomposition gasses cause the body to bloat (Epperly et al., 1996). Though floating, the body is still partially submerged and acts as a drifting object. The drift of a sea turtle carcass depends on the direction and intensity of local currents and winds. As sea turtles are vulnerable to human interactions such as fisheries bycatch and vessel strike, a number of studies have estimated at-sea mortality of marine turtles and the influence of nearshore physical oceanographic and wind regimes on sea turtle strandings. Although sea turtle stranding rates are variable, they may represent as low as five percent of total mortalities in some areas but usually do not exceed 20 percent of total mortality, as predators, scavengers, wind, and currents prevent carcasses from reaching the shore (Koch et al. 2013). Strandings of dead sea turtles from fishery interaction have been reported to represent as low as seven percent of total mortalities caused at sea (Epperly et al. 1996). Remote or difficult to access areas may further limit the amount of strandings that are observed. Because of the low probability of stranding under different conditions, determining total vessel strikes directly from raw numbers of stranded sea turtle data would vary between regions, seasons, and other factors such as currents.

To estimate unobserved vessel strike mortalities, we relied on available estimates from the literature. Based on data reviewed in Murphy and Hopkins-Murphy (1989), only six of 22 loggerhead sea turtle carcasses tagged within the South Atlantic and Gulf of Mexico region were reported in stranding records, indicating that stranding data represent approximately 27 percent of at-sea mortalities. In comparing estimates of at-sea fisheries induced mortalities to estimates of stranded sea turtle mortalities due to fisheries, Epperly et al. (1996) estimated that strandings represented 7 to13 percent of all at-sea mortalities.

Based on these two studies, both of which include waters of the U.S. East Coast, stranding data likely represent 7 to 27 percent of all at-sea mortalities. While there are additional estimates of the percent of at-sea mortalities likely to be observed in stranding data for locations outside the action area (e.g., Peckham et al. 2008, Koch et al. 2013), we did not rely on these since stranding rates depend heavily on beach survey effort, current patterns, weather, and seasonal factors among others, and these factors vary greatly with geographic location (Hart et al. 2006). Thus, based on the mid-point between the lower estimate provided by Epperly et al. (1996) of seven percent, and the upper estimate provided by Murphy and Hopkins-Murphy (1989) of 27 percent, we assume that the STSSN stranding data represent approximately 17 percent of all at sea mortalities. This estimate closely aligns with an analysis of drift bottle data from the Atlantic Ocean by Hart et al. (2006), which estimated that the upper limit of the proportion of sea turtle carcasses that strand is approximately 20 percent.

To estimate the annual average vessel strike mortalities corrected for unobserved vessel strike mortalities, we adjusted our calculated total presumed vessel mortality with the detection value of 17 percent. The resulting, adjusted number of vessel strike mortalities of each species in the southern New England region (Table 7.2.5) is presented in the "annual total presumed vessel mortalities" column in Table 7.2.5. We note that the 17 percent correction factor considers that all sea turtle species and at-sea mortalities are equally likely to be represented in the STSSN dataset. That is, sea turtles killed by vessel strikes are just as likely to strand or be observed at sea and be recorded in the STSSN database (i.e., 17%) as those killed by other activities, such as interactions with fisheries, and the likelihood of stranding once injured or killed does not vary by species. At this time, we do not have any information to indicate that this is not a reasonable conclusion.

Table 7.2.5. Estimated Annual Vessel Strike Mortalities Corrected for Unobserved Vessel Strike Mortalities in the Southern New England Region.

Sea Turtles	Presumed Vessel Mortalities* Over 10 years**	Total Over 10 Years (17% Detection Rate)	Annual Total Presumed Vessel Mortalities
NWA DPS Loggerhead sea turtle	34	200	20
NA DPS Green sea turtle	3	18	1.8
Leatherback sea turtle	33	195	19.5
Kemp's ridley sea turtle	3	18	1.8

* 93% of the total of "definitive vessel" plus "blunt force trauma"
** Rounded up from Table 7.2.4

To estimate the number of vessel strikes that may result from the proposed project, we considered the phase-specific increase in vessel traffic and calculated the expected increase in vessel strikes proportional to the increase in project vessel traffic. For these calculations, we assume a proportional relationship between vessel strikes and vessel traffic. As explained above, during the construction, operations, and decommissioning phases of the SouthCoast Wind project the vast majority of vessel traffic will occur between the SouthCoast Wind WDA and ports in southeast MA, RI, and CT. The formula used to generate the estimate of project vessel strikes over the construction, operations, and decommissioning phases is: (annual baseline strikes)*(% increase in traffic)*(years of project phase). Note that the calculations illustrated here consider a 5-year construction period, a 33-year operational period, and 5-year decommissioning period as this results in the greatest % increase per year. We also carried out these calculations using the lower percent increases for the longer construction period (7 years) and operational period (35 years) and note that, after rounding, there are no differences in the number of strikes estimated.

<u>Construction</u> = 2.94% increase in traffic for 5 years

Loggerhead sea turtles: (20)(0.0294)(5) = 2.94 loggerhead sea turtles

Green sea turtles: (1.8)(0. 0294)(5) = 0.26 green sea turtles

Leatherback sea turtles: (19.5)(0. 0294)(5) = 2.87 leatherback sea turtles

Kemp's Ridley sea turtles: (1.8)(0. 0294)(5) = 0.26 Kemp's Ridley sea turtles

<u>Operation</u> = 2.05% increase in traffic for 33 years

Loggerhead sea turtles: (20)(0.0205)(33) = 13.53 loggerhead sea turtles

Green sea turtles: (1.8)(0. 0205)(33) = 1.22 green sea turtles

Leatherback sea turtles: (19.5)(0. 0205)(33) = 13.19 leatherback sea turtles

Kemp's Ridley sea turtles: (1.8)(0. 0205)(33) = 1.22 Kemp's Ridley sea turtles

<u>Decommissioning</u> = 2.50% increase in traffic for 5 years

Loggerhead sea turtles: (20)(0.0250)(2) = 2.5 loggerhead sea turtle

Green sea turtles: (1.8)(0.0250)(2) = 0.23 green sea turtles

Leatherback sea turtles: (19.5)(0.0250)(2) = 2.44 leatherback sea turtles

Kemp's Ridley sea turtles: (1.8)(0. 0250)(2) = 0.23 Kemp's Ridley sea turtles

To determine the likely total number of sea turtles that will be struck by project vessels, we have added up the numbers for each phase then rounded up to whole animals. As such, based on our analysis, the proposed action is expected to result in vessel strike of sea turtles up to the number identified in Table 7.2.6 below:

Table 7.2.6. Estimate of Sea Turtle Vessel Strikes from Project Vessels Operating in the southern New England region.

Species	Maximum Vessel Strike Anticipated
NWA DPS Loggerhead sea turtle	19
NA DPS Green sea turtle	2
Leatherback sea turtle	19
Kemp's ridley sea turtle	2

While not all strikes of sea turtles are lethal, we have no way of predicting what proportion of strikes will be lethal and what proportion will result in recoverable injury. As such, for the purposes of this analysis, given the likelihood of vessel strike to cause serious injury or mortality, it is reasonable to assume that all strikes will result in serious injury or mortality.

Sea turtles are only present seasonally in this portion of the action area, primarily between June and October with a few individuals present earlier in the spring and few present through November. The calculations presented above do not reflect any consideration of the seasonal use of the action area which would limit the period each year where there is a risk of vessel strike. At this time we do not have sufficient data to adjust these calculations to account for the seasonal presence of sea turtles; this is largely because we do not have monthly estimates of project or baseline vessel traffic. We also note that it is likely not reasonable to assume even distribution of trips over the year due to seasonal limits on some activities (e.g., pile driving). Therefore, while acknowledging that these may be overestimates we consider them reasonable predictions of the amount of vessel strike that is likely to result from the increase in vessel traffic attributable to the SouthCoast Wind project.

As explained above in Section 7.2.2, SouthCoast Wind is proposing to take and/or BOEM is proposing to require a number of measures designed to minimize the potential for strike of a protected species that will be implemented over the life of the project. These include reductions in speed in certain areas, including certain times of the year to minimize the risk of vessel strike of large whales, the use of dedicated visual observers, slowing down if a sea turtle is sighted at any distance of the forward path of the operating vessel, the vessel operator must steer away from the individual at a speed of 4 knots or less, and seasonally avoiding transiting through areas of visible jellyfish aggregations or floating vegetation (e.g., sargassum lines or mats). While we expect that these measures will help to reduce the risk of vessel strike of sea turtles, individual sea turtles can be difficult to spot from a moving vessel at a sufficient distance to avoid strike due to their low-lying appearance. With this information in mind, we expect that the risk reduction measures that are part of the proposed action will reduce collision risk overall but will not eliminate that risk. We are not able to quantify any reduction in risk that may be realized and expect that any reduction in risk may be small.

Effects of Vessel Transits to/from Ports in Chesapeake Bay (Baltimore - Sparrows Point, MD) and the Nexans Facility at the Port of Charleston, SC and the SouthCoast Wind WDA

During the five to seven-year construction phase, SouthCoast Wind anticipates up to 8 vessel trips each between Sparrows Point Port, MD and the SouthCoast WDA and between the Nexans Facility at the Port of Charleston, SC and the SouthCoast WDA. During the operational phase, 2 vessel trips each between Sparrows Point Port, MD and the SouthCoast WDA and between the Nexans Facility at the Port of Charleston, SC and the SouthCoast WDA are estimated. No vessel transits are expected to these ports during decommissioning. These vessels would be cable lay barges and cable transport vessels, and may transit up to 15 knots except when subject to vessel speed restrictions that would limit speeds to up to 10 knots. Vessels transiting between these ports and the SouthCoast Wind WDA are expected to travel in shipping lanes when entering/leaving port and then transit offshore along the same routes as commercial vessels.

As described in Section 6, ESA listed sea turtles occur in this area in varying distribution and abundance throughout the year, with a notable seasonal pattern. All listed sea turtle species have a seasonal migration where they move into more northerly waters (i.e. northern Mid-Atlantic, southern New England, parts of the Gulf of Maine) during the summer and then migrate back through the Mid-Atlantic to more southern areas through the fall and occur there throughout the spring. During Project vessel transits to ports in the Mid-Atlantic, in the deeper offshore waters of the action area, the species and age classes most likely to be impacted are hatchlings and pre-recruitment juveniles of all sea turtle species, all age classes of leatherback sea turtles, and occasionally adult loggerheads. Hatchlings and pre-recruitment juveniles of all sea turtle species may also occur in open-ocean habitats, where they reside among Sargassum mats. Sea turtles are expected to be highly dispersed in deeper offshore waters and, given the large area over which Project vessels could potentially transit, the likelihood of co-occurrence is low in deeper offshore waters. In general, ESA listed sea turtles are expected to be highly dispersed in offshore waters on the continental shelf and, given the large area over which Project vessels could potentially transit, the likelihood of co-occurrence is low. Project vessels have the greatest chance to co-occur with sea turtles in the nearshore waters as vessels enter Chesapeake Bay (to transit to Sparrows Point) and Charleston Harbor (to transit to Port of Charleston); however, in these areas vessels are expected to be traveling slowly which decreases the risk of vessel strike.

Project vessels will represent an extremely small portion - up to 8 vessel trips each between Sparrows Point Port, MD and the SouthCoast WDA and between the Nexans Facility at the Port of Charleston, SC and the SouthCoast WDA during the during the five to seven-year construction phase, two vessel trips each between Sparrows Point Port, MD and the SouthCoast WDA and between the Nexans Facility at the Port of Charleston, SC and the SouthCoast WDA during the operational phase, and no vessel transits are expected to these ports during decommissioning - of the vessel traffic traveling through Mid-Atlantic waters to/from the SouthCoast Wind WDA. Considering, an estimated 74,000 vessel transits a year occur in the Mid-Atlantic area, this is an approximately 0.02% increase in traffic in this area, assuming that all of these trips represent “new” trips for vessels that otherwise would not be operating in this area and all 16 trips during the construction phase occur in one year. Given this extremely small increase in vessel traffic, any increased risk of vessel strike of sea turtles is also extremely small. During operations, only two trips to each port are expected, thus this risk is even lower. As such, we expect that SouthCoast Wind vessels operating in this portion of the action area are extremely unlikely to strike any sea turtles; therefore, effects of vessel traffic on sea turtles by vessel strike in this portion of the action area are discountable.

Effects of Vessel Transits to/from Ports in Salem, MA and the SouthCoast Wind WDA
During the five to seven-year construction phase, SouthCoast Wind anticipates up to 15 vessel trips between the WDA and ports in Salem, MA. During the operational phase, up to 117 vessel trips are anticipated and during decommissioning, 618 vessel trips are anticipated. These vessels would include heavy transport vessels, heavy installation vessels, guard/scout vessels, pre-lay grapnel run vessels, supply barges, survey vessels, anchor handling tugs, cable lay barges, cable transport vessels, dredging vessels, and support vessels. Vessels transiting between Salem, MA and the SouthCoast Wind WDA are expected to travel in the Boston traffic separation scheme outside of Cape Cod and then transit to the lease area. Sea turtles are seasonally present north and east of Cape Cod where vessels will transit, but in relatively low densities. Sea turtles are expected to be highly dispersed in these waters and, the likelihood of co-occurrence between project vessels and sea turtles is low.

Project vessels will represent a small portion (up to 15 total trips over the five to seven-year construction period, 117 trips during operations, and 618 trips during decommissioning) of the vessel traffic traveling in the area between Salem, MA and the SouthCoast Wind WDA. Information from the USCG's 2023 Port Access Route Study: Approaches to Maine, New Hampshire, and Massachusetts MA indicates that there are thousands of vessel transits per year in this area. Given the expected duration of each phase, this results in relatively few vessels trips per year, this will be a very small increase in traffic in this area. Given the relatively low density of sea turtles in this portion of the action area, their seasonal presence, and the small increase in vessel traffic that will result from SouthCoast Wind vessel trips between the WDA and Salem, any increase in risk of vessel strike in this area is expected to be extremely small such that vessel strike is extremely unlikely to occur and therefore, effects are discountable.

Effects of Vessel Transits in the U.S. EEZ South, East, and North of the SouthCoast Wind WDA
Due to project component and vessel availability, vessels will transit from ports in eastern Canada, Europe and Asia to the SouthCoast Wind WDA; this section considers vessel transits through the U.S. EEZ. These vessels will be heavy transport vessels, cable transport vessels, dredging vessels, and scour protection vessels during transit these vessels may travel up to 15 knots when not subject to vessel speed restrictions that would limit speed to 10 knots. BOEM has indicated that during the entire five to seven-year construction period there may be up to 64 vessel transits from ports in Europe/Asia to the U.S., up to 109 trips expected to travel from ports in eastern Canada, and up to 3 trips expected for vessels traveling through the Panama Canal before traveling to the WDA or local ports in the U.S. During the operational phase, there may be up to 37 vessel transits from ports in Europe/Asia to the U.S., up to 21 trips expected to travel from ports in eastern Canada, and no trips expected for vessels traveling through the Panama Canal before traveling to the WDA or local ports in the U.S. During the decommissioning phase, there may be up to 55 vessel transits from ports in Europe/Asia to the U.S., up to 55 trips expected to travel from ports in eastern Canada, and up to 7 trips expected for vessels traveling through the Panama Canal before traveling to the WDA or local ports in the U.S. Project vessels will represent an extremely small portion of the vessel traffic traveling through the EEZ during this period of time. In this portion of the action area, co-occurrence of project vessels and individual sea turtles is expected to be extremely unlikely; this is due to overall low abundance and limited seasonal occurrence of sea turtles in this portion of the action area, the dispersed

nature of sea turtles in the open ocean, and the only intermittent presence of project vessels. Based on this, it is extremely unlikely that any sea turtles will occur along the vessel transit route at the same time that a project vessel is moving through the area. Together, this makes it extremely unlikely that any ESA listed sea turtles will be struck by a project vessel. Therefore, effects of vessel transits on sea turtles by vessel strike in this portion of the action area are discountable.

Effects of Vessel Transits to/from Ports in the Gulf of Mexico and the SouthCoast Wind WDA
During the five to seven-year construction phase, SouthCoast Wind anticipates up to 71 vessel trips between two ports in the Gulf of Mexico (Corpus Christ, TX and Altamira, Mexico), no trips during the operational phase, and only 9 trips from the port of Corpus Christi, TX during the decommissioning phase. These vessels would include heavy transport vessels, supply barges, and tugboats and may transit up to 16 knots when not subject to vessel speed restrictions. Vessels transiting between these ports and the SouthCoast Wind WDA are expected to travel in shipping lanes when entering/leaving port and then transit offshore along the same routes as commercial vessels around Florida and then along the U.S. East Coast.

In general, ESA listed sea turtles are expected to be highly dispersed in offshore waters on the continental shelf and, given the large area over which Project vessels could potentially transit, the likelihood of co-occurrence is low. As described in Section 6, ESA listed sea turtles are most common in the Gulf of Mexico and the U.S. South Atlantic, however, there is variability in their distribution and abundance throughout the year. Project vessels have the greatest chance to co-occur with sea turtles in the nearshore waters as the vessel comes into or leaves ports in the Gulf of Mexico; however, in these areas vessels are expected to be moving slowly which decreases the risk of vessel strike.

Project vessels will represent an extremely small portion (up to 71 trips over the five to seven-year construction period, no trips during the operational phase, and 9 trips during the decommissioning phase) of the vessel traffic traveling through the Gulf of Mexico and South Atlantic waters to/from the SouthCoast Wind. Given the number of major ports along the South Atlantic and Gulf of Mexico, vessel traffic is expected to be similar or higher to the Mid-Atlantic (approximately 74,000 vessel transits a year). Considering, an estimated 74,000 vessel transits a year occur in the Mid-Atlantic area, during the construction phase, this project vessel traffic is about an 0.01% increase in traffic in this area, assuming that all of these trips represent "new" trips for vessels that otherwise would not be operating in this area. During the operational phase and decommissioning phase, this would be even a lower percentage of vessel traffic. Given this extremely small increase in vessel traffic, any increased risk of vessel strike of sea turtles is also extremely small. As such, we expect that SouthCoast Wind vessels operating in this portion of the action area are extremely unlikely to strike any sea turtles; therefore, effects of vessel traffic on sea turtles by vessel strike in this portion of the action area are discountable.

Summary of Effects of Vessel Traffic on ESA Listed Sea Turtles
In summary, we expect that the operation of project vessels over the life of the proposed action (i.e., 40 years) will result in the strike and mortality of up to 19 loggerhead, 2 green, 19 leatherback, and 2 Kemp's ridley sea turtles.

7.2.3.4 Consideration of Potential Shifts in Vessel Traffic

Here, we consider how the proposed project may result in shifts or displacement of existing vessel traffic. As presented in the Navigational Safety Risk Assessment ("NSRA" see COP Appendix X), the proposed WTG spacing is sufficient to allow the passage of vessels between the WTGs, and the directional trends of the vessel data are roughly in-line with the direction of the rows of WTGs as currently designed. However, transit through the lease area will be a matter of risk tolerance, and up to the individual vessel operators. While the presence of the WTGs and ESPs will not result in any requirements to reroute vessel traffic, it is possible that it will result in changes to vessel routes due to operator preferences and risk tolerances.

Currently, vessel traffic in the SouthCoast Wind WDA is primarily recreational vessels and fishing vessels which transit the area in non-uniform patterns. Larger vessels such as cargo, tug, or tanker vessels transit the SouthCoast Wind WDA infrequently as these larger vessels primarily transit the Nantucket to Ambrose TSS and TSS routes into New Bedford and Buzzards Bay which are south and west of the SouthCoast Wind WDA, respectively. Depending on final layout, existing vessel traffic may transit within the turbines in the SouthCoast Wind WFA, or operators may avoid the SouthCoast Wind WFA and transit around it. However, we do not expect that this potential shift in traffic would increase the risk of interaction with listed species as we have not identified any areas where a theoretical risk of vessel strike would increase due to co-occurrence of vessels and whales, sea turtles, or Atlantic sturgeon being more likely such that risk of ship strike would increase. As such, even if there is a shift in vessel traffic outside of the WDA or any other change in traffic patterns due to the construction and operation of the project, any increase in risk of vessel strike is expected to be extremely unlikely to occur and therefore, effects are discountable.

7.2.4 Air Emissions Regulated by the OCS Air Permit

SouthCoast Wind has applied for OCS Air Permits from the EPA. The application was considered complete in April 2023 but to date, EPA has not issued a draft OCS air permit for public comment. As described by EPA, the Outer Continental Shelf (OCS) Air Regulations, found at 40 CFR part 55, establish the applicable air pollution control requirements, including provisions related to permitting, monitoring, reporting, fees, compliance, and enforcement, for facilities subject to the Clean Air Act (CAA) section 328.

The "potential to emit" for the SouthCoast Wind Projects' OCS sources includes emissions from vessels installing the WTGs and the ESPs, engines on vessels that meet the definition of an OCS source, and engines (including any generators) on the WTGs and ESPs. Criteria air pollutant emissions and their precursors generated from the construction and operation of the windfarm include nitrogen oxides, carbon monoxide, sulfur dioxide, particulate matter, and volatile organic compounds. These air pollutants are associated with the combustion of diesel fuel in a vessel's propulsion and auxiliary engines and the engine(s) located on WTGs and OSSs. As described by EPA, project impacts are compared to the national ambient air quality standards (NAAQS) and Prevention of significant deterioration (PSD) increments to demonstrate the project will not cause or contribute to a violation of these standards. The NAAQS are health-based standards that the EPA sets to protect public health with an adequate margin of safety. The PSD increments are designed to ensure that air quality in an area that meets the NAAQS does not significantly deteriorate from baseline levels.

At this time, there is no information on the effects of air quality on listed species that may occur in the action area. However, as the NAAQS and PSD increments are designed to ensure that air quality in the area regulated by the permit do not significantly deteriorate from baseline levels, it is reasonable to conclude that any effects to listed species from emissions that comply with these requirements would be so small that they cannot be meaningfully measured, detected, or evaluated and, therefore, are insignificant. Reinitiation of consultation may be required if permit terms and/or effects are likely to be different than anticipated.

7.3 Effects to Species during Construction

Here, we consider the effects of the proposed action on listed species from exposure to stressors as well as alterations or disruptions to habitat and environmental conditions caused by project activities during the construction phase of the project. Specifically, we address inter-array and export cable installation including the sea-to-shore transition, turbidity resulting from project activities including dredging, cable installation, foundation installation, and installation of scour protection, project lighting during construction, and seabed disturbance from potential UXO detonations. Noise associated with these activities is discussed in Section 7.1 *Underwater Noise*; associated vessel activities are discussed in Section 7.2 *Effects of Project Vessels*.

7.3.1 Cable Installation

As described in Section 3.2.3 *Cable Installation* above, a number of cables will be installed as part of the SouthCoast Wind project. Activities associated with cable installation include seabed preparation, cable laying, and activities to support the sea-to-shore transition at the landfall locations. The proposed action includes one preferred export cable corridor to Brayton Point, Massachusetts and one variant export cable corridor to Falmouth, Massachusetts. The Brayton Point export cable corridor will be used for both Project 1 and Project 2, while the Falmouth variant export cable corridor would only be used for Project 2 in the event that technical, logistical, grid interconnection, or other unforeseen challenges arise during the design and engineering phase that prevents Project 2 from making an interconnection at Brayton Point. Effects of these activities are described here.

SouthCoast is proposing to lay the inter-array cable and offshore export cable using cable installation equipment that would include a combination of a vertical injector, jetting sled, jetting ROV, pre-cut plow, mechanical plow, or a mechanical cutting ROV system. Cable laying and burial may occur simultaneously using a lay and bury tool, or the cable may be laid on the seabed and then trenched post-lay. Cables will be buried to a target depth of 6 feet (1.8 meters) where possible. The burial method will be dependent on suitable seabed conditions and sediments along the cable route. For locations where target burial depth cannot be achieved, cable protection would be used.

SouthCoast Wind estimates 10 percent of the inter-array cable layout would require cable protection (approximately 49.7 miles) (SouthCoast BA, 2024). SouthCoast Wind also estimates a maximum of 15 percent (18.6 miles) of the Brayton Point export cable corridor and 10 percent (14.0 kilometers) of the Falmouth variant cable corridor would require cable protection (SouthCoast Wind BA, 2023). The proposed cable protection types for both the inter-array and the export cables include the following: (1) rock berms, (2) concrete mattresses, (3) rock/crushed boulder placement, (4) fronded mattress; (5) half shell placement (SouthCoast BA, 2024). Effects of habitat conversion resulting from cable protection are addressed in Section 7.4 *Effects to Habitat and Environmental Conditions during Construction*.

The offshore export cables will connect with onshore export cables. The Brayton Point export cable corridor will have a maximum of six offshore export cables, including four HVDC power cables and two dedicated communication cables, which would then connect the OSPs to the landfall site at Brayton Point. Within the Brayton Point export cable corridor, no sand wave clearance is expected. Mechanical dredging will occur at up to 12 HDD exit pits, removing a total of up to 22,404 cubic yards of material, for the Brayton Point export cable corridor, including four in the Sakonnet River and eight in Mount Hope Bay (SouthCoast Wind BA, 2024). No sand wave clearance is proposed along the Brayton Point cable corridor

The Falmouth variant export cable corridor could contain a maximum of five offshore export cables including four power cables and one dedicated communication cable, which would then connect the OSPs to the landfall site in Falmouth (SouthCoast Wind BA, 2023). Seabed preparation is expected within 5 percent of the Falmouth variant export cable corridor for sand wave clearance via a trailing suction hopper dredger or similar tool (SouthCoast Wind BA, 2024). Dredging may also occur at the Falmouth variant export cable corridor HDD exit pit locations. The total volume of dredged material, including sand wave clearance and dredging at the HDD exit pits is estimated to be 646,077 cubic yards for the Falmouth variant export cable corridor (SouthCoast Wind BA, 2024).

SouthCoast Wind intends to maintain a maximum corridor width of 2,300 feet (700 meters) for the Brayton Point export cable corridor and 3,280 feet (1,000 meters) for the Falmouth variant export cable corridor (SouthCoast Wind BA, 2023). Dredging at HDD exit pit locations and sand waves along portions of the offshore export cable corridors to support cable installation is addressed below.

7.3.1.1 Pre-lay Grapnel Run and Boulder Relocation

Prior to installation of the cables, a pre-lay grapnel run would be performed to locate and clear obstructions such as abandoned fishing gear, UXOs, and other marine debris. Additionally, large boulders that cannot be avoided would be relocated from the cable path with a boulder grab or boulder plow. A displacement plow is a Y-shaped tool composed of a boulder board attached to a plow. The plow is pulled along the seabed and scrapes the seabed surface pushing boulders out of the cable corridor. In some locations, a boulder grab tool deployed from a DP vessel would also be used to relocate isolated or individual boulders.

The pre-lay grapnel run will involve towing a grapnel, via the main cable-laying vessel, along the benthos of the cable burial route. During the pre-lay grapnel run, the cable-lay vessel will tow the grapnel at slow speeds (i.e., approximately 1 knot or less) to ensure all debris is removed. Given the very slow speed of the operation, any listed species in the vicinity are expected to be able to avoid the devices and avoid an interaction. Additionally, the cable for the grapnel run and displacement plow will remain taut as it is pulled along the benthos; there is no risk for any listed species to become entangled in the cable. For these reasons, any interaction between the pre-lay grapnel run, a displacement plow, or a boulder grab tool and ESA-listed species is extremely unlikely to occur. As any material moved during the pre-lay grapnel run and associated boulder relocation would be placed adjacent to the cable corridor any effects to listed species from these changes in the structure of the habitat are extremely unlikely to occur. As such, effects to listed species from these activities are discountable.

7.3.1.2 Cable Laying

Cable laying operations proceed at speeds of <1 knot. At these speeds, any sturgeon, sea turtle, or whale is expected to be able to avoid any interactions with the cable laying operation. Additionally, as the cable will be taut as it is unrolled and laid in the trench, there is no risk of entanglement. Based on this information adverse effects caused by this activity, including entanglement of any species during the cable laying operation, is extremely unlikely to occur, and are therefore, discountable. Effects of turbidity from cable laying are considered below.

7.3.1.3 Dredging and Sand Wave Clearance to Facilitate Cable Installation

Following the pre-lay grapnel run, dredging for sand wave clearance is proposed for some portions of the Falmouth export cable corridor. Sand wave clearance is proposed along approximately 5 percent of the Falmouth export cable corridor, primarily within the Muskeget Channel and Nantucket Sound. Figure 3.1-9 in the SouthCoast Wind BA provides a map that shows the anticipated sand wave clearance areas within the Falmouth variant cable corridor where micro-siting of the cables cannot avoid these features. The areas where dredging may occur include 52 acres of large grained complex habitat, 140 acres of complex habitat, and 237 acres of soft bottom habitat.

Generally, sand wave features are dynamic and have wavelengths that consist of hundreds of meters with heights of several meters and typically migrate several meters per day (Terwindt, 1971, Campmans et al., 2021). As described in the BA, wave clearance volumes were estimated based on sand wave height, anticipated cable burial depth, the most likely cable installation technique, and the required clearance area.

As described in the BA, a controlled flow excavator (CFE) or hopper dredge would be used for sand wave clearance. The CFE uses jets of water to move sand and does not come into contact with the substrate. Given that there is no contact with the substrate and sand is not entrained or otherwise removed through the CFE there is not expected to be any risk of impingement, entrainment, capture, or other sources of injury associated with the CFE. As such, effects to listed species from interactions with the CFE are extremely unlikely to occur and are discountable.

Hydraulic trailing suction hopper dredging involve the use of a suction to either remove sediment from the seabed or relocate sediment from a particular location on the seafloor. A hopper dredge may be used for sand wave clearance; effects of removing approximately 600,000 cubic yards of sand along the Falmouth export cable corridor are addressed below.

Effects of Hopper Dredge – Sand Wave Clearance

Given their large size, there is no risk of impingement, entrainment, or capture of any ESA listed whales in a hopper dredge; as such, these effects are extremely unlikely to occur and discountable.

Hopper Dredge Interactions – Sea Turtles
Sea turtles have been known to become entrained in trailing suction hopper dredges, which can result in severe injury or mortality (Dickerson et al., 2004; USACE 2020). Animal interactions with a hopper dredge occur primarily from crushing when the draghead is placed on the bottom of the seabed or when an animal is unable to escape the suction of the dredge and becomes stuck on the draghead (impingement). Further, entrainment occurs when animals are sucked through the draghead into the hopper. Mortality most often occurs when animals are sucked into the dredge draghead, pumped through the intake pipe, and then killed as they cycle through the centrifugal pump and into the hopper.

Interactions with the draghead can also occur if the suction is turned on while the draghead is in the water column (i.e., not seated on the bottom). For any dredging that occurs to support cable installation, procedures will be required to minimize the operation of suction when the draghead is not properly seated on the bottom sediments, which reduces the risk of these types of interactions.

The risk of interaction between suction hopper dredging and individual sea turtles is expected to be lower in the open ocean areas compared to nearshore navigational channels where sea turtles may be more concentrated and constrained (Michel et al., 2013; USACE 2020). Documented turtle mortalities during dredging operations in the USACE South Atlantic Division (SAD; i.e., south of the Virginia/North Carolina border) are more common than in the USACE North Atlantic Division (NAD; Virginia-Maine) presumably due to the greater abundance of turtles in these waters and the greater frequency of hopper dredge operations. For example, in the USACE SAD, over 480 sea turtles have been entrained in hopper dredges since 1980 and in the Gulf Region over 200 sea turtles have been killed since 1995. Records of sea turtle entrainment in the USACE NAD began in 1994. Through 2018, 88 sea turtles deaths (see Table 7.31) related to hopper dredge activities have been recorded in waters north of the North Carolina/Virginia border (USACE Sea Turtle Database[46]); 79 of these turtles have been entrained in dredges operating in Chesapeake Bay.

Interactions are likely to be most numerous in areas where sea turtles are resting or foraging on the bottom. When sea turtles are at the surface, or within the water column, they are not likely to interact with the dredge because there is little, if any, suction force in the water column. Sea turtles have been found resting in deeper waters, which could increase the likelihood of interactions from dredging activities. In 1981, observers documented the take of 71 loggerheads by a hopper dredge at the Port Canaveral Ship Channel, Florida (Slay and Richardson 1988). This channel is a deep, low productivity environment in the Southeast Atlantic where sea turtles are known to rest on the bottom, making them extremely vulnerable to entrainment. The large number of turtle mortalities at the Port Canaveral Ship Channel in the early 1980s resulted in part

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[46] The USACE Sea Turtle Data Warehouse is maintained by the USACE's Environmental Laboratory and contains information on USACE dredging projects conducted since 1980 with a focus on information on interactions with sea turtles.

from turtles being buried in the soft bottom mud, a behavior known as brumation. Since 1981, 77 loggerhead sea turtles have been taken by hopper dredge operations in the Port Canaveral Ship Channel, Florida. Chelonid turtles have been found to make use of deeper, less productive channels as resting areas that afford protection from predators because of the low energy, deep water conditions. Habitat in the action area is not consistent with areas where sea turtle brumation has been documented; therefore, we do not anticipate any sea turtle brumation in the action area.

As noted above, in the North Atlantic Division area, nearly all interactions with sea turtles have been recorded in nearshore bays and estuaries where sea turtles are known to concentrate for foraging (i.e., Chesapeake Bay and Delaware Bay). Very few interactions have been recorded at offshore dredge sites or in New England waters generally. This may be because in offshore areas there are more opportunities for escape from the dredge as compared to a narrow river, harbor entrance, or dredged navigation channel. Sea turtles may also be less likely to be resting or foraging at the bottom while in open ocean areas, which would further reduce the potential for interactions. Additionally, sea turtles are less common and occur in lower density in New England waters compared to the Mid or South Atlantic where dredge interactions are more frequent.

Before 1994, endangered species observers were not required on board hopper dredges and dredge baskets were not inspected for sea turtles or sea turtle parts. The majority of sea turtle takes in the NAD have occurred in the Norfolk district. This is largely a function of the large number of loggerhead and Kemp's ridley sea turtles that occur in the Chesapeake Bay each summer and the intense dredging operations that are conducted to maintain the Chesapeake Bay entrance channels and for beach nourishment projects at Virginia Beach. Since 1992, the take of nine sea turtles (all loggerheads) has been recorded during hopper dredge operations in the Philadelphia, Baltimore, and New York Districts.

Table 7.3.1. Recorded Sea Turtle Takes in USACE NAD Dredging Operations

Project Location	Year of Operation	Cubic Yardage Removed	Observed Takes
Cape Henry Channel	2018	2,500,000	1 loggerhead
Thimble Shoals Channel	2016	1,098,514	1 loggerhead
York Spit Channel	2015	815,979	6 loggerheads
Cape Henry Channel	2014	2,165,425	3 loggerheads 1 Kemp's ridley
Sandbridge Shoal	2013	815,842	1 loggerhead[47]
Cape Henry Channel	2012	1,190,004	1 loggerhead
York Spit	2012	145,332	1 Loggerhead
Thimble Shoal Channel	2009	473,900	3 Loggerheads
York Spit	2007	608,000	1 Kemp's Ridley

[47] Sea turtle observed in cage on beach (material pumped directly to beach from dredge).

Cape Henry	2006	447,238	3 Loggerheads
Thimble Shoal Channel	2006	300,000	1 loggerhead
Delaware Bay	2005	50,000	2 Loggerheads
Thimble Shoal Channel	2003	1,828,312	7 Loggerheads 1 Kemp's ridley 1 unknown
Cape Henry	2002	1,407,814	6 Loggerheads 1 Kemp's ridley 1 green
VA Beach Hurricane Protection Project (Cape Henry)	2002	1,407,814	1 Loggerhead
York Spit Channel	2002	911,406	8 Loggerheads 1 Kemp's ridley
Cape Henry	2001	1,641,140	2 loggerheads 1 Kemp's ridley
VA Beach Hurricane Protection Project (Thimble Shoals)	2001	4,000,000	5 loggerheads 1 unknown
Thimble Shoal Channel	2000	831,761	2 loggerheads 1 unknown
York River Entrance Channel	1998	672,536	6 loggerheads
Atlantic Coast of NJ	1997	1,000,000	1 Loggerhead
Thimble Shoal Channel	1996	529,301	1 loggerhead
Delaware Bay	1995	218,151	1 Loggerhead
Cape Henry	1994	552,671	4 loggerheads 1 unknown
York Spit Channel	1994	61,299	4 loggerheads
Delaware Bay	1994	NA	1 Loggerhead
Cape May NJ	1993	NA	1 Loggerhead
Off Ocean City MD	1992	1,592,262	3 Loggerheads
			TOTAL = 88 Turtles

Typically, endangered species observers are required to observe at least 50% of the dredge activity (i.e., 6 hours on watch, 6 hours off watch). To address concerns that some loads would be unobserved, procedures have been in place since at least 2002 to insure that inflow cages were only inspected and cleaned by observers. This maximizes the potential that any entrained sea turtles were observed and reported.

It is possible that not all sea turtles killed by dredges are observed onboard the hopper dredge. Several sea turtles stranded on Virginia shores with crushing type injuries from May 25 to October 15, 2002. The Virginia Marine Science Museum (VMSM) found 10 loggerheads, 2

Kemp's ridleys, and 1 leatherback exhibiting injuries and structural damage consistent with what they have seen in animals that were known dredge takes. While it cannot be conclusively determined that these strandings were the result of dredge interactions, it is reasonable to conclude that the death of these sea turtles was attributable to dredging operations given the location of the strandings (e.g., in the southern Chesapeake Bay near ongoing dredging activity), the time of the documented strandings in relation to dredge operations, the lack of other ongoing activities which may have caused such damage, and the nature of the injuries (e.g., crushed or shattered carapaces and/or flipper bones, black mud in mouth). In 1992, three dead sea turtles were found on an Ocean City, Maryland beach while dredging operations were ongoing at a borrow area located 3 miles offshore. Necropsy results indicate that the deaths of all three turtles were dredge related. Because there were no observers on board the dredge, it is unknown if turtles observed on the beach with these types of injuries were crushed by the dredge and subsequently stranded on shore or whether they were entrained in the dredge, entered the hopper and then were discharged onto the beach with the dredge spoils. Further analyses need to be conducted to better understand the link between crushed strandings and dredging activities, and if those strandings need to be factored into an incidental take level. Regardless, it is possible that dredges are taking animals that are not observed on the dredge, which may result in strandings on nearby beaches. However, there is not enough information at this time to determine the number of injuries or mortalities that are not detected.

The number of interactions between dredge equipment and sea turtles seems to be best associated with the volume of material removed, which is closely correlated to the length of time dredging takes, with a greater number of interactions associated with a greater volume of material removed and a longer duration of dredging. The number of interactions is also heavily influenced by the time of year dredging occurs (with more interactions correlated to times of year when more sea turtles are present in the action area) and the type of dredge plant used (sea turtles are apparently capable of avoiding pipeline and mechanical dredges as no takes of sea turtles have been reported with these types of dredges). The number of interactions may also be influenced by the terrain in the area being dredged, with interactions more likely when the draghead is moving up and off the bottom frequently. Interactions are also more likely at times and in areas when sea turtle forage items are concentrated in the area being dredged, as sea turtles are more likely to be spending time on the bottom while foraging.

We are not aware of any hopper dredging that has occurred in the areas that may be dredged as part of the SouthCoast Wind project. The concentration of sea turtles in Chesapeake Bay is much higher than we anticipate for the areas to be dredged; therefore, using these projects to calculate an entrainment rate (i.e., sea turtles entrained per dredge volume) would result in a significant overestimate of the likelihood of interactions in the action area. We have calculated an entrainment rate by combining hopper dredge projects operating in Delaware Bay, in borrow areas on the Mid-Atlantic OCS, and mid-Atlantic navigation channels that have not used screening for unexploded ordnance (such screening decreases the ability of observers to detect entrained turtles) but have utilized endangered species observers for monitoring. These projects are combined in the table 7.3.2 below. Using these projects to calculate an entrainment rate is expected to result in a reasonable estimate of risk given the geographic similarity to the SouthCoast Wind hopper dredge areas. The entrainment rate calculated for the projects listed in Table 7.3.1 indicates that entrainment of a sea turtle is likely to occur for every 3.8 million cubic yards of material removed with a hopper dredge (calculated by dividing the total cubic yards removed by the number of sea turtles entrained: 15,280,061 CY / 4 sea turtles = 3,820,015).

Table 7.3.2. Hopper dredging projects in the Mid-Atlantic without UXO screens and with endangered species observers.

Project Name	Year	CY Removed	Sea Turtle Interactions
Wallops Island, VA (OCS Borrow Area)	2013	1,000,000	0
Delaware Bay (Reach D)	2013	1,149,946	0
Wallops Island, VA (OCS Borrow Area)	2012	3,200,000	0
LBI Surf City	2006-2007	880,000	0
Delaware Bay - Channel Maintenance	2006	390,000	0
Delaware Bay - Channel Maintenance	2005	50,000	1
Delaware Bay - Channel Maintenance	2005	167,982	0
Delaware Bay	2005	162,682	0
Fenwick Island	2005	833,000	0
Cape May	2004	290,145	0
Delaware Bay - Channel Maintenance	2004	50,000	0
Cape May Meadows	2004	1,406,000	0
Cape May	2002	267,000	0
Delaware Bay - Channel Maintenance	2002	50,000	0 (bone)

Delaware Bay - Channel Maintenance	2001	50,000	0
Cape May City	1999	400,000	0
Delaware Bay - Channel Maintenance	1995	218,151	1
Bethany Beach and South Bethany Beach	1994	184,451	0
Delaware Bay - Channel Maintenance	1994	2,830,000	1
Dewey Beach	1994	624,869	0
Cape May	2005	300,000	0
Fenwick Island*	1998	141,100	0
Delaware Bay - Channel Maintenance (Brandywine)	1993	415,000	1
Bethany Beach*	1992	219,735	0
		15,280,061	**4**

Dredging (sand wave leveling) associated with the installation of the Falmouth variant export cable corridor will remove approximately 600,000 cubic yards of sediment. Considering the entrainment rate calculated above, we would predict entrainment of no more than 0.165 sea turtles during dredging (sand wave leveling) for the proposed Falmouth variant export cable corridor. Considering that only a portion of the proposed dredging would occur when sea turtles are present in the action area (i.e., dredging may occur at any time of year and sea turtles are only likely to be present June – November), that the dredging will occur in areas with low densities of sea turtles and that the interaction rate is largely based on dredge events in more southern waters where sea turtles are more numerous, the risk is even lower. Based on this, interactions between the dredge and sea turtles are extremely unlikely to occur and effects are discountable. No capture, impingement, or entrainment of any sea turtles is anticipated and no take is expected.

Hopper Dredge Interactions – Atlantic Sturgeon

Sturgeon are vulnerable to interactions with hopper dredges. The risk of interactions is related to both the amount of time sturgeon spend on the bottom and the behavior the fish are engaged in (i.e., whether the fish are overwintering, foraging, resting or migrating) as well as the intake velocity and swimming abilities of sturgeon in the area (Clarke 2011). Intake velocities at a typical large self-propelled hopper dredge are 11 feet per second. As noted above, exposure to the suction of the draghead intake is minimized by not turning on the suction until the draghead is properly seated on the bottom sediments and by maintaining contact between the draghead and the bottom.

A significant factor influencing potential entrainment is based upon the swimming stamina and size of the individual fish at risk (Boysen and Hoover, 2009). Swimming stamina is positively correlated with total fish length. Entrainment of larger sturgeon such as the ones in the action area is less likely due to the increased swimming performance and the relatively small size of the draghead opening. Juvenile entrainment is possible depending on the location of the dredging operations and the time of year in which the dredging occurs. Typically, major concerns of juvenile entrainment relate to fish below 200 mm (Hoover et al., 2005; Boysen and Hoover, 2009). Juvenile sturgeon are not powerful swimmers and they are prone to bottom-holding behaviors, which make them vulnerable to entrainment when in close proximity to dragheads (Hoover et al., 2011). Juvenile sturgeon do not occur in the action area. The estimated minimum size for sturgeon that out-migrate from their natal river is greater than 50cm; therefore, that is the minimum size of sturgeon anticipated in the action area.

In general, entrainment of large mobile animals, such as the Atlantic sturgeon in the action area, is relatively rare. Several factors are thought to contribute to the likelihood of entrainment. In areas where animals are present in high density, the risk of an interaction is greater because more animals are exposed to the potential for entrainment. The risk of entrainment is likely to be higher in areas where the movements of animals are restricted (e.g., in narrow rivers or confined bays) where there is limited opportunity for animals to move away from the dredge than in unconfined areas such as wide rivers or open bays. The hopper dredge draghead operates on the bottom and is typically at least partially buried in the sediment. Sturgeon are benthic feeders and are often found at or near the bottom while foraging or while moving within rivers. Sturgeon at or near the bottom could be vulnerable to entrainment if they were unable to swim away from the draghead. Atlantic sturgeon are not anticipated to be foraging in the sediment in the areas to be dredged given that they are areas of dynamic sand waves that would not support benthic invertebrates that sturgeon would forage on. As such, sturgeon are not anticipated to be so close to the sediment to be vulnerable to entrainment in the hopper dredge. If Atlantic sturgeon are up off the bottom while in offshore areas, such as the action area, the potential for interactions with the dredge are further reduced. Based on this information, the likelihood of an interaction of an Atlantic sturgeon with a hopper dredge operating in the action area is expected to be low.

Nearly all recorded entrainment of sturgeon during hopper dredging operations has been during maintenance or deepening of navigation channels within rivers with spawning populations of Atlantic sturgeon. We have records of three Atlantic sturgeon entrainments outside of such river channels. Two of these are from York Spit Channel, Virginia and based on the state of decomposition of one of these it was not killed interacting with the dredge. The other record is from the Sandy Hook Channel in New Jersey. To calculate an entrainment rate for Atlantic sturgeon that would be a reasonable estimate for the action area, we have considered projects where hopper dredges operated without UXO screens and with endangered species observers and where we expect the observers would have reported any observations of sturgeon. We have limited the projects considered to those that are outside of rivers or other inland areas as the size class of sturgeon present in those areas would be different from the action area and we expect behavior of sturgeon to be different in those areas. As such, the level of entrainment in these areas would not be comparable to the level of interactions that may occur in the action area.

Table 7.3.3: Hopper Dredging Operations in areas within the USACE NAD similar to the action area (only projects that operated without UXO screens, and carried observers and complete records available are included)

Project Location	Year of Operation	Cubic Yards Removed	Observed Entrainment
Wallops Island offshore VA borrow area	2013	1,000,000	0
Wallops Island offshore VA borrow area	2012	3,200,000	0
York Spit Channel, VA	2011	1,630,713	1
Cape Henry Channel, VA	2011	2,472,000	0
York Spit Channel, VA	2009	372,533	0
Sandy Hook Channel, NJ	2008	23,500	1
York Spit Channel, VA	2007	608,000	0
Atlantic Ocean Channel, VA	2006	1,118,749	0
Thimble Shoal Channel, VA	2006	300,000	0
Cape May	2004	290,145	0
Thimble Shoal Channel, VA	2004	139,200	0
VA Beach Hurricane Protection Project	2004	844,968	0
Thimble Shoal Channel	2003	1,828,312	0
Cape May	2002	267,000	0
Cape Henry Channel, VA	2002	1,407,814	0
York Spit Channel, VA	2002	911,406	0
East Rockaway Inlet, NY	2002	140,000	0
Cape Henry Channel, VA	2001	1,641,140	0

Thimble Shoal Channel, VA	2000	831,761	0
Cape Henry Channel, VA	2000	759,986	0
Cape May City	1999	400,000	0
York Spit Channel, VA	1998	296,140	0
Cape Henry Channel, VA	1998	740,674	0
Thimble Shoal Channel, VA	1996	529,301	0
East Rockaway Inlet, NY	1996	2,685,000	0
Cape Henry Channel, VA	1995	485,885	0
East Rockaway Inlet, NY	1995	412,000	0
York Spit Channel, VA	1994	61,299	0
Cape Henry Channel , VA	1994	552,671	0
	TOTAL	25,950,197	2

In the absence of any dredging in the action area to base an entrainment estimate, we consider other projects that have been conducted in a comparable environment to that of the action area (see Table 7.3.3). As noted above, based on what we know about Atlantic sturgeon behavior in environments comparable to the action area, we consider the risk of entrainment at this site is similar to that of the projects identified in Table 7.3.3. At this time, this is the best available information on the potential for interactions with Atlantic sturgeon.

Using this method, and using the dataset presented in Table 7.3.3, we have calculated an interaction rate indicating that for every 12.98 million cubic yards of material removed, one Atlantic sturgeon is likely to be injured or killed. This calculation is based on a number of assumptions including the following: that Atlantic sturgeon are evenly distributed throughout the action area, that all hopper dredges will have the same entrainment rate, and that Atlantic sturgeon are equally likely to be encountered throughout the time period when dredging will occur. While this estimate is based on several assumptions, it is reasonable because it uses the best available information on entrainment of Atlantic sturgeon from past dredging operations, including dredging operations in the vicinity of the action area: it includes multiple projects over several years, and all of the projects have had observers present which we expect would have documented any entrainment of Atlantic sturgeon.

Suction hopper dredging associated with the installation of the Falmouth variant export cable corridor will remove approximately 600,000 cubic yards of dredged material. Considering the entrainment rate calculated above, we would predict entrainment of no more than 0.053 Atlantic sturgeon during suction hopper dredging for the proposed Falmouth variant export cable corridor installation. Considering that the dredging will occur outside of any area where sturgeon are known to aggregate and outside of channels and bays where dredge interactions are expected to be more likely to occur (i.e., high use areas adjacent to rivers with spawning populations), the risk is likely even lower. Based on this, interactions between the dredge and Atlantic sturgeon are extremely unlikely to occur and effects are discountable. No capture, impingement, or entrainment of any Atlantic sturgeon is anticipated and no take is expected.

Jet Plowing during Cable Laying

The jet plow uses jets of water to liquefy the sediment, creating a trench in which the cable is laid. Cable laying operations proceed at speeds of <1 knot. At these speeds, any sturgeon, sea turtle, or whale is expected to be able to avoid any interactions with the cable laying operation. Additionally, as the cable will be taut as it is unrolled and laid in the trench, there is no risk of entanglement. Based on this information, adverse effects caused by this activity, including entanglement of any species during cable laying operation, is extremely unlikely to occur.

Sea to Shore Transition

For the Brayton Point export cable corridor, two potential transition locations at Brayton Point in Somerset, Massachusetts, and four potential transition locations at the intermediate landfall on Aquidneck Island in Portsmouth, Rhode Island are considered part of the proposed action. For the Falmouth variant export cable corridor, three potential sea-to-shore transition locations (Worcester Avenue, Central Park, and Shore Street) in Falmouth, Massachusetts are considered as part of the proposed action.

Installation of the SouthCoast Wind offshore export cables will connect onshore at the above-mentioned landfall locations via HDD. The HDD methodology will involve drilling underneath the seabed and the intertidal area using a drilling rig positioned onshore. HDD seaward exit points would be within 3,500 feet of the shoreline for the Falmouth variant export cable corridor and within 1,000 feet of the shoreline for the Brayton Point landfall locations. At the seaward exit point, construction activities may include either a temporary gravity-based structure (gravity cell or gravity-based cofferdam) and/or a dredged exit pit. Installation of both the temporary gravity-based structure and/or dredged exit pit would not require pile driving or hammering. A conductor pipe made of high-density polyethylene or similar material may be installed at the exit pit locations to support drilling. Conductor pipe installation will include pushing, and no pile driving is planned. Excavation methods at the nearshore HDD exit pit locations may use dredging equipment such as a trailing suction hopper, controlled flow excavator, or mechanical dredge. The HDD exit pits locations will be in shallow water depths (<10 meters).

Sea to Shore Transition – Dredging at the Brayton Point and Aquidneck Island HDD Sites

As mentioned above in Section 7.3.1 *Cable Installation*, dredging will occur at up to twelve HDD exit pits for the Brayton Point export cable corridor, including four in the Sakonnet River and eight in Mount Hope Bay. Excavated material at the HDD exit pit locations are planned to be side casted on the seafloor adjacent to the excavated areas. Within each of the three Brayton Point export cable corridor HDD areas, the four HDD exit pits are anticipated to have a dredged volume of 1,867 cubic yards per pit for a total of 7,468 cubic yards per HDD area and 22,404 cubic yards for the Brayton Point export cable corridor as a whole. For the Falmouth variant export cable corridor, dredging will occur at up to four HDD exit pits.

Water injection dredging is a proposed methodology for excavation at HDD exit pits but other options such as trailing suction hopper dredging and mechanical dredging may also be used. Water injection dredging involves spraying water at a low pressure onto the substrate, which fluidizes the sediment so it moves out of the area; there is no potential for impingement, entrainment, or capture of any ESA listed species with the dredge technique. Risks to listed species from hopper dredging are addressed above; those conclusions apply to the HDD exit pits as well, with risk even lower considering the much smaller dredge volumes. Below, we consider the effects of mechanical dredging.

Mechanical dredging entails lowering the open bucket or clamshell through the water column, closing the bucket after impact on the bottom, lifting the bucket up through the water column, and emptying the bucket into a barge or truck. The bucket operates without suction or hydraulic intake, moves relatively slowly through the water column, and impacts only a small area of the aquatic bottom at any time. In order to be captured in a dredge bucket, an animal must be on the bottom directly below the dredge bucket as it impacts the substrate and remain stationary as the bucket closes. Species captured in dredge buckets can be injured or killed if entrapped in the bucket or buried in sediment during dredging and/or when sediment is deposited into the dredge scow. Species captured and emptied out of the bucket can suffer stress or injury, which can lead to mortality.

Given the nearshore locations where mechanical dredging will occur, ESA listed whales are not expected to be present. Even if whales were present in the area to be dredged, they are far too large to be susceptible to capture or entrapment by a mechanical dredge. As such, interactions with mechanical dredges are extremely unlikely to occur and effects on ESA listed whales are discountable.

Sea turtles are seasonally present along the cable route and may be present in the area where mechanical dredging is planned. However, sea turtles are not known to be vulnerable to capture in mechanical dredges, presumably because they are able to avoid the dredge bucket. Thus, if a sea turtle were to be present at the dredge sites, it would be extremely unlikely to be captured, injured, or killed as a result of dredging operations carried out by a mechanical dredge, because of the anticipated behavioral response. That response, however, would likely be short and the sea turtle would resume its normal behavior without fitness consequences once it perceived it was safe. Based on this information, interactions between sea turtles and the mechanical dredge causing adverse effects are extremely unlikely to occur. Any effects to individual sturgeon from avoiding the dredge bucket will be so small that they cannot be meaningfully measured, detected, or evaluated and are therefore insignificant.

The risk of interactions between sturgeon and mechanical dredges is generally considered very low but is thought to be highest in areas where large numbers of sturgeon are known to aggregate. The risk of capture may also be related to the behavior of the sturgeon in the area. While foraging, sturgeon are at the bottom interacting with the sediment. This behavior may increase the susceptibility of capture with a dredge bucket. For entrapment to occur, an individual sturgeon would have to be present directly below the dredge bucket at the time of operation and be unable to escape. Mechanical dredging is a common activity throughout the range of Atlantic sturgeon and very few interactions have ever been recorded. Given that dredging will not occur in areas where few Atlantic sturgeon are anticipated to occur, the co-occurrence of an Atlantic sturgeon and the dredge bucket is extremely unlikely. As such, entrapment or any interactions with sturgeon causing adverse effects during the dredging operations is also extremely unlikely and thus discountable. Any effects to individual sturgeon from avoiding the dredge bucket will be so small that they cannot be meaningfully measured, detected, or evaluated and are therefore insignificant.

7.3.2 Turbidity from Cable Installation and Dredging Activities

Installation of the SouthCoast Wind export cables and inter-array cables would disrupt bottom habitat and suspend sediment in the water column. Potential types of equipment that may cause temporary increases in turbidity and sediment resuspension during cable installation include the use of a jet ROV, pre-cut low, mechanical plow, or a mechanical cutting ROV system.

During cable installation, the use of a jet plow is expected to produce the most measure suspended sediments. Typically, jet plowing releases more turbidity than mechanical plowing methods (SouthCoast Wind BA, 2024). As described in the BA, TSS concentrations from the use of a jet plow during cable installation would produce approximately 235 mg/L at 65 feet (20 meters) with concentrations decreasing to 43 mg/L within 656 feet (200 meters). Sediment transport analysis conducted for SouthCoast predicted that redeposition of suspended sediments would occur quickly; total suspended solid concentrations above 100 milligrams per liter (mg/L) (0.0008 pounds per gallon) are predicted to extend a maximum of 1,214 feet (370 meters) for any scenario except for the nearshore arears of the Brayton Point corridor, where suspended sediments extended to just over 0.6 miles (1 kilometer). The maximum total suspended solid level is expected to drop below 1 mg/L (0.00008 pounds per gallon) within 2 hours for all simulated scenarios and dropped below 1 mg/L (0.000008 pounds per gallon) within 4 hours for any scenario except for nearshore areas of the Brayton Point corridor, where 200 mg/L and 10 mg/L concentrations lasted for longer than 2 hours and several hours after re-suspension. Deposition thickness exceeding 0.2 inches (5 millimeters) were generally limited to a corridor with a maximum width of 79 feet (24 meters) around the cable routes but reached a maximum of 590 feet (180 meters) from the centerline of the inter-array cables (COP Appendices F1 and F3; SouthCoast Wind BA, 2024).

Modeling results from suction dredging for the HDD exit pits indicated that elevated TSS levels will impact a limited area. For both neap and spring tides, sediment concentrations exceeding 10 mg/L (0.00008 pounds per gallon) are found at a maximum distance of 755 feet (230 meters) and 492 feet (150 meters), with the impact areas reaching approximately 4.2 acres and 3.7 acres. Similarly, deposited sediments exceeding 0.2 inches (5 millimeter) thickness for the neap and spring tides are expected to occur 85 feet (26 meters) and 105 feet (32 meters) from the HDD exit pit locations. Given the static nature of dredging at the HDD exit pit locations, sediment deposition is expected to be greater than deposition from the use of a jet plow during cable installation.

All sediment impacts from dredging and cable installation would be localized around the source of disturbance and intermittent in association with the duration of bed-disturbing activities.

Whales
In a review of dredging impacts to marine mammals, Todd et al. (2015) found that direct effects from turbidity have not been documented in the available scientific literature. Because whales breathe air, some of the concerns about impacts of TSS on fish (i.e., gill clogging or abrasion) are not relevant. Cronin et al. (2017) suggest that vision may be used by North Atlantic right whales to find copepod aggregations, particularly if they locate prey concentrations by looking upwards. However, Fasick et al. (2017) indicate that North Atlantic right whales certainly must rely on other sensory systems (e.g. vibrissae on the snout) to detect dense patches of prey in very dim light (at depths >160 meters or at night). Because ESA listed whales often forage at depths deeper than light penetration (i.e., it is dark), which suggests that vision is not relied on exclusively for foraging, TSS that reduces visibility would not be expected to affect foraging ability. Data are not available regarding whales avoidance of localized turbidity plumes; however, Todd et al. (2015) conclude that since marine mammals often live in turbid waters and frequently occur at depths without light penetration, impacts from turbidity are not anticipated to occur. As such, any effects to ESA listed whales from exposure to increased turbidity during cable installation are extremely unlikely to occur and thus discountable. If turbidity-related effects did occur, they would likely be so small that they cannot be meaningfully measured, evaluated, or detected and would therefore be insignificant. Effects to whale prey are considered below.

Sea Turtles
Similar to whales, because sea turtles breathe air, some of the concerns about impacts of TSS on fish (i.e., gill clogging or abrasion) are not relevant. There is no scientific literature available on the effects of exposure of sea turtles to increased TSS. Michel et al. (2013) indicates that since sea turtles feed in water that varies in turbidity levels, changes in such conditions are extremely unlikely to inhibit sea turtle foraging even if they use vision to forage. Based on the available information, we expect that any effects to sea turtles from exposure to increased turbidity during dredging or cable installation are extremely unlikely to occur and thus discountable. If turbidity-related effects did occur, they would likely be so small that they could not be meaningfully measured, evaluated, or detected and would therefore be insignificant. Effects to sea turtle prey are addressed below in Section 7.3.3., *Impacts of Cable Installation Activities on Prey*.

Atlantic sturgeon
Atlantic sturgeon are adapted to natural fluctuations in water turbidity through repeated exposure (e.g., high water runoff in riverine habitat, storm events) and are adapted to living in turbid environments (Hastings 1983, ECOPR Consulting 2009). Atlantic sturgeon forage at the bottom by rooting in soft sediments meaning that they are routinely exposed to high levels of suspended sediments. Few data have been published reporting the effects of suspended sediment on sturgeon. Garakouei et al. (2009) calculated Maximum Allowable Concentrations (MAC) for total suspended solids in a laboratory study with *Acipenser stellatus* and *A. persicus* fingerlings (7-10 cm TL). The MAC value for suspended sediments was calculated as 853.9 mg/L for *A. stellatus* and 1,536.7 mg/L for *A. persicus*. All stellate sturgeon exposed to 1,000 and 2,320 mg/L TSS for 48 hours survived. All Persian sturgeon exposed to TSS of 5,000, 7,440, and 11,310 mg/L for 48 hours survived. Given that Atlantic sturgeon occupy similar habitats as these sturgeon species, we expect them to be a reasonable surrogate for Atlantic sturgeon.

Wilkens et al. (2015) contained young of the year Atlantic sturgeon (100-175 mm TL) for a 3-day period in flow-through aquaria, with limited opportunity for movement, in sediment of varying concentrations (100, 250 and 500 mg L−1 TSS) mimicking prolonged exposure to suspended sediment plumes near an operating dredge. Four-percent of the test fish died; one was exposed to 250 TSS and three to 500 TSS for the full three-day period. The authors concluded that the impacts of sediment plumes associated with dredging are minimal where fish have the ability to move or escape. As tolerance to environmental stressors, including suspended sediment, increases with size and age (ASMFC, 2012); we expect that the subadult and adults in the action area would be less sensitive to TSS than the test fish used in both of these studies.

Any Atlantic sturgeon within 10 m (16 ft.) of the cable laying operations for the inter-array cable would be exposed to TSS greater than 50 mg/L. TSS plumes >100 mg/L could persist up to two hour but do not persist for any activity for longer than two hours (SouthCoast Wind BA, 2024). Atlantic sturgeon within 5 m (16 ft.) of the cable laying operations for the SouthCoast Wind export cable would be exposed to TSS at 50 to 100 mg/L. Elevated TSS levels associated with SouthCoast Wind export cable-OSS installation are not expected to persist for more than four hours.

Appendix F1 of the SouthCoast COP concluded that the maximum TSS concentration levels dropped below 10 mg/L (0.000008 lbs/gal) in two hours for any of the simulated scenarios, while levels dropped below 1 mg/L (0.000008 lb/gal) after less than four hours. Given that both the modeled and observed TSS effects would be short term and within the range of baseline variability. Based on the information summarized above, any exposure to TSS would be below levels that would be expected to result in any effects to the subadult or adult Atlantic sturgeon occurring in the action area. As such, any effects to Atlantic sturgeon are expected to be so small that they cannot be meaningfully measured, evaluated, or detected and therefore, effects are insignificant. Effects to Atlantic sturgeon prey are addressed below.

7.3.3 Impacts of Cable Installation Activities on Prey

Here we consider the potential effects of cable installation on prey of whales, sea turtles, and Atlantic sturgeon due to impacts of sediment disturbance during dredging or cable laying and resulting exposure to increased TSS. We provide a brief summary of the prey that the various listed species forage on and then consider the effects of dredging and cable installation on prey, with the analysis organized by prey type. We conduct this analysis to consider whether listed species could be exposed to adverse effects due to adverse consequences to species on which they forage.

Summary of Information of Feeding of ESA-listed Species

Right whales

Right whales feed almost exclusively on copepods, a type of zooplankton. Of the different kinds of copepods, North Atlantic right whales feed especially on late stage *Calanus finmarchicu*s, a large calanoid copepod (Baumgartner et al.. 2007), as well as *Pseudocalanus spp*. and *Centropages spp*. (Pace and Merrick 2008). Because a right whale's mass is ten or eleven orders of magnitude larger than that of its prey (late stage *C. finmarchicus* is approximately the size of a small grain of rice), right whales are very specialized and restricted in their habitat requirements

– they must locate and exploit feeding areas where copepods are concentrated into high-density patches (Pace and Merrick 2008).

Fin whales
Fin whales in the North Atlantic eat pelagic crustaceans (mainly euphausiids or krill, including *Meganyctiphanes norvegica* and *Thysanoessa inerrnis*) and schooling fish such as capelin (*Mallotus villosus*), herring (*Clupea harengus*), and sand lance (*Ammodytes spp*.) (NMFS 2010). Fin whales feed by lunging into schools of prey with their mouth open, using their 50 to 100 accordion-like throat pleats to gulp large amounts of food and water. A fin whale eats up to 2 tons of food every day during the summer months.

Sei whales
An average sei whale eats about 2,000 pounds of food per day. They can dive 5 to 20 minutes to feed on plankton (including copepods and krill), small schooling fish, and cephalopods (including squid) by both gulping and skimming.

Sperm whales
Sperm whales hunt for food during deep dives with feeding occurring at depths of 500–1000 m depths (NMFS 2010). Deepwater squid make up the majority of their diet (NMFS 2010). Given the shallow depths of the area where the cable will be installed (less than 50 m), it is extremely unlikely that any sperm whales would be foraging in the area affected by the cable installation and extremely unlikely that any potential sperm whale prey would be affected by cable installation or dredging activities.

Blue whales
Blue whales feed exclusively on krill. Given the rarity of blue whales in the area where project activities will occur, it is extremely unlikely that any blue whales would be foraging in the area where increased turbidity would occur and extremely unlikely that any potential blue whale prey would be affected by cable installation or dredging activities.

Sea turtles
Green sea turtles feed primarily on sea grasses and may feed on algae. Loggerhead turtles feed on benthic invertebrates such as gastropods, mollusks, and crustaceans. Diet studies focused on North Atlantic juvenile stage loggerheads indicate that benthic invertebrates, notably mollusks and benthic crabs, are the primary food items (Burke et al. 1993, Youngkin 2001, Seney 2003). Limited studies of adult loggerheads indicate that mollusks and benthic crabs make up their primary diet, similar to the more thoroughly studied neritic juvenile stage (Youngkin 2001). Kemp's ridleys primarily feed on crabs, with a preference for portunid crabs including blue crabs; crabs make up the bulk of the Kemp's ridley diet (NMFS et al. 2011).

Leatherback sea turtles feed exclusively on jellyfish. A study of the foraging ecology of leatherbacks off the coast of Massachusetts indicates that leatherbacks foraging off Massachusetts primarily consume the scyphozoan jellyfishes, *Cyanea capillata* and *Chrysaora quinquecirrha*, and ctenophores, while a smaller proportion of their diet comes from holoplanktonic salps and sea butterflies (*Cymbuliidae*) (Dodge et al. 2011); we expect leatherbacks in the SouthCoast Wind area to be foraging on similar species.

Atlantic sturgeon
Atlantic sturgeon are opportunistic benthivores that feed primarily on mollusks, polychaete worms, amphipods, isopods, shrimps and small bottom-dwelling fishes (Smith 1985, Dadswell 2006). A stomach content analysis of Atlantic sturgeon captured off the coast of New Jersey indicates that polycheates were the primary prey group consumed; although the isopod *Politolana concharum* was the most important individual prey eaten (Johnson et al. 2008). The authors determined that mollusks and fish contributed little to the diet and that some prey taxa (i.e., polychaetes, isopods, amphipods) exhibited seasonal variation in importance in the diet of Atlantic sturgeon. Novak et al. (2017) examined stomach contents from Atlantic sturgeon captured at the mouth of the Saco River, Maine and determined that American Sand Lance *Ammodytes americanus* was the most common and most important prey.

7.3.4.1 Effects of Cable Installation Activities on the Prey Base of ESA-listed Species in the Action Area

Dredging
Dredging will result in a temporary loss of benthic prey in the areas being dredged. We have considered the potential effects on sea turtles and Atlantic sturgeon that may forage opportunistically along the sand waves where dredging will occur. Given the dynamic nature of sand waves, the area is subject to frequent shifting sediments.

Given that the areas impacted are small and will be dispersed along the cable route and that recolonization is expected, any losses of benthic resources will be small and temporary. Therefore, effects to Atlantic sturgeon and sea turtles are expected to be so small that they cannot be meaningfully measured, detected, or evaluated and will be insignificant.

Exposure to Increased Turbidity
Copepods
Copepods exhibit diel vertical migration; that is, they migrate downward out of the euphotic zone at dawn, presumably to avoid being eaten by visual predators, and they migrate upward into surface waters at dusk to graze on phytoplankton at night (Baumgartner and Fratantoni 2008; Baumgartner et al. 2011). Baugmartner et al. (2011) concludes that there is considerable variability in this behavior and that it may be related to stratification and presence of phytoplankton prey with some copepods in the Gulf of Maine remaining at the surface and some remaining at depth. Because copepods even at depth are not in contact with the substrate, we do not anticipate any burial or loss of copepods during installation of the cable. We were unable to identify any scientific literature that evaluated the effects to marine copepods of exposure to TSS. Based on what we know about effects of TSS on other aquatic life, it is possible that high concentrations of TSS could negatively affect copepods. However, given that: the expected TSS levels are below those that are expected to result in effects to even the most sensitive species evaluated; the sediment plume will be transient and temporary (i.e., persisting in any one area for no more than three hours); elevated TSS is limited to the bottom 3 meters of the water column; and will occupy only a small portion of the WFA at any given time, any effects to copepod availability, distribution, or abundance on foraging whales would be so small that they could not be meaningfully evaluated, measured, or detected. Therefore, effects are insignificant.

Fish
As explained above, elevated TSS will be experienced along the cable corridor during cable installation. Anticipated TSS levels are below the levels expected to result in the mortality of fish that are preyed upon by fin or sei whales or Atlantic sturgeon. In general, fish can tolerate at least short-term exposure to high levels of TSS. Wilber and Clarke (2001) reviews available information on the effects of exposure of estuarine fish and shellfish to suspended sediment. In an assessment of available information on sublethal effects to non-salmonids, they report that the lowest observed concentration–duration combination eliciting a sublethal response in white perch was 650 mg/L for 5 d, which increased blood hematocrit (Sherk et al. 1974 in Wilber and Clarke 2001). Regarding lethal effects, Atlantic silversides and white perch were among the estuarine fish with the most sensitive lethal responses to suspended sediment exposures, exhibiting 10% mortality at sediment concentrations less than 1,000 mg/L for durations of 1 and 2 days, respectively (Wilber and Clarke 2001). Forage fish in the action area will be exposed to maximum TSS concentration-duration combinations far less than those demonstrated to result in sublethal or lethal effects of the most sensitive non-salmonids for which information is available. Based on this, we do not anticipate the mortality of any forage fish; therefore, we do not anticipate any reduction in fish as prey for fin or sei whales or Atlantic sturgeon; any effects to these listed species as a result of effects to prey will be so small that they cannot be meaningfully measured, evaluated, or detected and are therefore insignificant.

Benthic Invertebrates
In the BA, BOEM indicates that jet plowing is expected to produce a maximum TSS concentration of approximately 235 mg/L at 65 feet from the jet plow with concentrations decreasing to 43 mg/L within 656 feet of the jet plow (NMFS 2020a citing ESS Group; SouthCoast Wind BA, 2023). This activity is likely to result in the mortality of some benthic invertebrates in the path of the jet plow. Immediately following cable installation, this area will likely be devoid of any benthic invertebrates. However, given the narrow area, we expect recolonization to occur from adjacent areas that were not disturbed; therefore, this reduction in potential forage will be temporary.

As explained above, elevated TSS will be experienced along the cable corridor during cable installation. Because polychaete worms live in the sediment, we do not expect any effects due to exposure to elevated TSS in the water column. Wilbur and Clarke (2001) reviewed available information on effects of TSS exposure on crustacean and report that in experiments shorter than 2 weeks, nearly all mortality of crustaceans occurred with exposure to concentrations of suspended sediments exceeding 10,000 mg/L and that the majority of these mortality levels were less than 25%, even at very high concentrations. Wilbur and Clarke (2001) also noted that none of the crustaceans tested exhibited detrimental responses at dosages within the realm of TSS exposure anticipated in association with dredging. Based on this information, we do not anticipate any effects to crustaceans resulting from exposure to TSS associated with cable installation. Given the thin layer of deposition associated with the settling of TSS out of the water column following cable installation we do not anticipate any effects to benthic invertebrates. Based on this analysis, we expect any impact of the loss of benthic invertebrates to foraging Kemp’s ridley and loggerhead sea turtles and Atlantic sturgeon due to cable installation to be so small that they cannot be meaningfully measured, evaluated, or detected and, therefore, are insignificant.

Jellyfish
A literature search revealed no information on the effects of exposure to elevated TSS on jellyfish. However, given the location of jellyfish in the water column and the information presented in the BA that indicates that any sediment plume associated with cable installation will be limited to the bottom 3 meters of the water column, we expect any exposure of jellyfish to TSS to be minimal. Based on this analysis, effects to leatherback sea turtles resulting from effects to their jellyfish prey are extremely unlikely to occur and thus discountable.

SAV/Eelgrass (Zostera marina)
SAV beds were identified only at the Falmouth variant export cable landfall areas during a review of eelgrass field surveys that were completed in August 2020 for the SouthCoast Wind project (SouthCoast Wind BA, 2024). The documented eelgrass beds extend between approximately 1,970 to 3,120 feet from the shoreline where the Falmouth variant export cable landfall sites are located (SouthCoast Wind COP Appendix K). To avoid direct impacts to the documented SAV beds at the Falmouth variant landfall sites, SouthCoast Wind will utilize a HDD installation methodology during the sea-to-shore transition work for the cables at the landfall sites (SouthCoast Wind BA, 2024). The HDD installation method would effectivity reduce any impacts to eelgrass and thus have no impacts on habitat or forage resources for ESA-listed sea turtles. Effects to sea turtles are extremely unlikely to occur and thus, discountable.

Water Withdrawal for Jet Trenching
Jet trencher equipment uses seawater to circulate through hydraulic motors and jets during installation. Although this seawater is released back into the ocean, survival rates of entrained eggs, larvae, and zooplankton are unknown and it is possible that all entrained organisms will be killed. Only early life stages may be affected by jet plow entrainment; later life stages will not be affected. These will be one-time losses and will occur over a short period. A previous assessment conducted for the South Fork Wind Farm found that the total estimated losses of zooplankton and ichthyoplankton from jet trencher entrainment were less than 0.001% of the total zooplankton and ichthyoplankton abundance present in the project area, which encompassed a linearly buffered region of 15 km around the export cable and 25 km around the wind farm (INSPIRE Environmental, 2018). We would expect similar impacts from the SouthCoast Wind cable installation. Given the extremely small, localized, and one-time losses of ichthyoplankton, we expect any effects to the forage base for ESA listed species would be equally small, localized, and temporary. As such, effects to ESA listed species are expected to be so small that they cannot be meaningfully measured, detected, or evaluated and are therefore, insignificant.

7.3.4 Turbidity during WTG and OSS Foundation Installation
Pile driving for WTG and OSP installation as well as the deposition of materials for scour protection at the base of these foundations may result in a minor and temporary increase in suspended sediment in the area immediately surrounding the foundation or scour protection being installed. The amount of sediment disturbed during these activities is minimal; thus, any associated increase in TSS will be small and significantly lower than the TSS associated with

cable installation addressed above. Given the very small increase in TSS associated with foundation installation and placement of scour protection, any physiological or behavioral responses by ESA listed species from exposure to TSS are extremely unlikely to occur. Similarly, effects to listed species from any effects to prey would be too small to meaningfully measure, detect, or evaluate, and therefore, are insignificant.

7.3.5 Installation of Suction Bucket Foundations

As described in the BA (see also Figure 3.1-5 in the BA), SouthCoast Wind may use suction-bucket jacket foundations for up to 85 wind turbine generators in the southern portion of the Lease Area (i.e., for Project 2 as an alternative to pile driven foundations). Each suction-bucket jacket foundation will be made up of four buckets (one per leg) with each bucket having a diameter of up to 65.6 feet (20 meters), a penetration depth of up to 65.6 feet (20 meters), and a volume of approximately 8,894 cubic yards. If it occurs, BOEM and SouthCoast anticipate that suction-bucket installation would occur over a 16-month period between the start of Q2 in the year 2030 (April 2030) to the start of Q3 2030 (July 2031).

As described in the BA and in Section 3 *Description of the Proposed Action* of this Opinion, to facilitate the installation of suction bucket foundations, a low-flow suction pump is installed at the top of each caisson (or “bucket”). During deployment, after the suction bucket has settled into the seafloor due to gravity, the suction pump will slowly remove water from within the bucket to create an area of reduced pressure against the seafloor, which will assist the suction bucket in completing penetration to the target depth. It is anticipated that the pump will operate at low enough rates so as not to disturb bottom sediments. As such, while there may be some minor suspension of sediment as the bucket settles into the sediment, no turbidity or suspended sediment is anticipated to result from the pumping operations. Effects to listed species due to disturbance of bottom sediments and pumping of water, inclusive of consideration of effects to prey, from installation of the suction bucket foundations are extremely unlikely to occur and thus discountable.

Impingement and Entrainment – Effects on Prey

Potential entrainment of prey is considered in Section 5.5.11 of BOEM’s BA. In the BA, BOEM describes an entrainment assessment carried out for installation of suction-bucket foundations (RPS 2024). Here we consider the effects of the loss of potential prey species due to impingement or entrainment during suction bucket foundation installation for the SouthCoast Wind Farm Project for ESA-listed whales, sea turtles, and Atlantic sturgeon that may be foraging in the action area.

For the analysis, the presence and abundance of plankton species was determined using NOAA NEFSC Ecosystem Monitoring (EcoMon) survey data from an area within 5 km of the foundation installation area. This analysis area was determined by BOEM to be appropriate given that foundation installation is a one-time localized action with short-term entrainment impacts, limited only to the period of time when each foundation is being installed. Monthly entrainment estimates for suction-bucket foundation installations were calculated using a per foundation one-time total seawater displacement volume of 27,200 cubic meters (6,800 m^3 per bucket x 4 buckets per foundation), the assumption that the installation of 85 suction-bucket jacket foundations would occur evenly over a 16-month period from April 2030 to July 2031, and the taxa-specific EcoMon plankton density data averaged by month. As described in the BA, a total of 91 taxa were assessed, with the most abundant being Calanoid copepods. The assessment calculated the numbers of individuals from the various taxa that could be entrained during suction bucket installation.

The highest estimated total entrainment for all ichthyoplankton and zooplankton taxa combined occurred in the months of May and June which coincided with peak abundance for Calanoid copepods and the months where the most suction-bucket jacket foundation installations occurred (RPS 2024). Entrainment estimates generally followed monthly plankton density trends given that these calculations are density dependent with the exception of April, May, June, and July where foundation installations were double that of the other months. Among zooplankton species, *C. finmarchicus* had the highest estimated entrainment at 342,688,524 individuals in the month of May. For ichthyoplankton species identified to at least genus, Atlantic mackerel had the highest estimated entrainment in the month of June at 944,475 individuals. Total estimated entrainment (number of individuals) by taxa from start to completion of suction-bucket jacket foundation installation was highest for *C. finmarchicus* (874,641,271), *C. typicus* (820,148,482), *Pseudocalanus* spp. (609,183,491) and *T. longicornis* (308,384,062) among zooplankton taxa and Atlantic mackerel (954,383), sand lance (869,447), gulf stream flounder (507,854), and hake (488,465) among ichthyoplankton taxa. In comparison to the estimated entrainment for the most abundant Calanoid copepod species, entrainment of salps was an order of magnitude less at 78,698,098 individuals in total for this construction activity (RPS 2024).

As the installation of suction bucket jacket foundations is a one-time localized action, entrainment impacts are considered short-term and limited to the immediate vicinity of the installation activity. In a similar entrainment assessment conducted for the cooling water intake system of the Sunrise Wind Farm offshore converter station with an intake volume of 8.1 million gallons per day and an estimated annual entrainment for *C. finmarchicus* of 1.1 billion individuals, TRC (2022) reported that this magnitude of entrainment loss represented less than 0.1 percent of the estimated local population of this species in the Sunrise Wind Farm Lease Area. In comparison, plankton entrainment estimates from suction-bucket jacket installations are considerably less, would be a one-time event, and would impact an even smaller percentage of the plankton population in the vicinity of the SouthCoast Wind suction bucket foundation installation area.

Effects to potential prey species due to impingement or entrainment during suction bucket foundation installation for the SouthCoast Wind Farm Project are expected to be minor, localized around the suction-bucket foundation, short in duration, and only occur during the installation process. For these reasons, we expect effects to potential prey species to be so small that they cannot be meaningfully measured, evaluated, or detected and thus insignificant. We also note that while specifics of the pump were not described in the BA, in assessments of other suction bucket foundation installations (e.g., BA for the Atlantic Shores South Project), BOEM indicates that the pump will have screens with mesh size of approximately 0.841 mm (i.e., openings in the mesh are smaller than 1 mm). Combined with the anticipated low pump speed, this would l make impingement or entrainment of any aquatic organisms, including small prey items such as copepods (2-5 mm), extremely unlikely to occur.

Given that specifics of the pump are not available, we consider here that the entrainment described in the BA may occur. However, given that loss of any copepods or other prey species are expected to amount to less than 0.1% of the monthly abundance in the area, the reduction in prey from what otherwise would occur in the lease area is expected to be undetectable from natural variability. As such, we expect any effects to foraging right whales to be so small that they cannot be meaningfully measured, detected, or evaluated, and therefore, are insignificant.

Similarly, it is expected that the mortality of early life stages of benthic and pelagic prey species will be no more than 0.1% of the abundance in the lease area and be indistinguishable from natural variability. Given the available information, effects to listed species from the potential entrainment of plankton during the installation of any suction bucket foundations will be so small that they cannot be meaningfully measured, evaluated, or detected and are therefore, insignificant.

7.3.6 Lighting

In general, lights will be required on offshore platforms and structures, vessels, and construction equipment during construction. Construction activities would occur 24 hours a day; construction and support vessels would be required to display lights when operating at night and deck lights would be required to illuminate work areas. However, lights would be down shielded to illuminate the deck, and would not intentionally illuminate surrounding waters. If sea turtles, Atlantic sturgeon, whales, or their prey is attracted to the lights, it could increase the potential for interaction with equipment or associated turbidity. However, due to the nature of project activities and associated seafloor disturbance, turbidity, and noise, listed species and their prey are not likely to be attracted by lighting because they are disturbed by these other factors. As such, we have determined that any effects of project lighting on sea turtles, sturgeon, or whales are extremely unlikely to occur.

Lighting may also be required at on shore areas, such as where the cables will make landfall. Many of the onshore areas used for staging will be part of an industrial port where artificial lighting already exists. Sea turtle hatchlings are known to be attracted to lights and artificial beach lighting is known to disrupt proper orientation towards the sea. However, sea turtle nesting does not occur in New England; therefore, there is no potential for project lighting to impact the orientation of any sea turtle hatchlings in known nesting beaches. Lighting on shore areas will therefore have no effect on listed sea turtle.

7.3.7 Unexploded Ordnance (UXO) Detonation - Seabed Disturbance and Turbidity

The proposed action includes the detonation of up to 10 UXOs. Therefore, we are assessing the potential effects to the seabed from potential UXO blasting/detonation; in the BA, BOEM describes 5 potential UXO detonations along the cable route and 5 within the lease area. In Section 7.1 *Underwater Noise*, effects to whales, sea turtles, and Atlantic sturgeon from exposure to UXO/MEC detonations were addressed.

There is very limited information about seabed disturbances following the blasting/detonation of UXOs. Generally, it can be assumed that the detonation of a UXO may leave a crater or scar in the seabed following blasting. The total seabed area disturbed is expected to be related to the size of the UXO, the existing seabed conditions, and the UXO detonation method. SouthCoast

Wind proposes to first avoid interaction with any existing UXOs. If avoidance cannot be achieved, physical relocation through a "Lift and Shift" strategy where a UXO is moved to another suitable location would be next. In situations where UXOs cannot be avoided or physically relocated, a low-order (deflagration) method would be considered. Deflagration, a low-order detonation method, consists of a shape charge with insufficient shock to detonate, and with the explosive material inside the UXO reaching with a rapid burning rather than a chain reaction that would lead to a full explosion (ESTCP 2002, Robinson *et al*. 2020, Lepper, pers. comm. 2022). Deflagration would have little to no impact on the seabed as there is not a full explosion, thus we would not expect much disturbance of the surrounding substrate. A high-order detonation is conducted by exploding a donor charge placed adjacent to the UXO munition (Albright 2012, Aker et al. 2013, Sayle et al. 2009, Cooper and Cooke 2018, Robinson et al. 2020). In the event of a high-order UXO detonation, it is likely that the seabed around the location of the UXO will be disturbed. Given the sandy substrate in areas where UXO could be detonated and the dynamic benthic environment, we expect any craters or scars to fill in naturally over time. We do not expect any effects to listed species from these impacts. Additionally, while there could be increases in turbidity as sediment is disturbed during a detonation, any sediment would quickly settle out of the water column; effects to listed species from a localized, temporary increase in suspended sediment are expected to be so small that they cannot be meaningfully measured, evaluated, or detected, and are therefore insignificant.

7.4 Effects to Habitat and Environmental Conditions during Operation

Here, we consider the effects to listed species from alterations or disruptions to habitat and environmental conditions during the operations phase of the project. Specifically, we address electromagnetic fields, heat during cable operation, project lighting during operations, the effects of project structures, and effects of operations of the offshore converter substation-direct current (OCS-DC1, also referred to as the HVDC OSP in the BA) including effects of water withdrawal (impingement or entrainment of listed species and their prey), and effects of the discharge of effluent (exposure to pollutants, including heat, and effects on prey).

7.4.1 Electromagnetic Fields and Heat during Cable Operation

Electromagnetic fields (EMF) are generated by current flow passing through power cables during operation and can be divided into electric fields (called E-fields, measured in volts per meter, V/m) and magnetic fields (called B-fields, measured in μT) (Taormina et al. 2018). Buried cables reduce, but do not entirely eliminate, EMF (Taormina et al. 2018). When electric energy is transported, a certain amount is lost as heat by the Joule effect, leading to an increase in temperature at the cable surface and a subsequent warming of the sediments immediately surrounding the cable; for buried cables, thermal radiation can warm the surrounding sediment in direct contact with the cable, even at several tens of centimeters away from it (Taormina et al. 2018). The proposed action includes installation of up to 1,179 miles of export cables (if both the Falmouth and Brayton Point ECC are installed) and 497 miles of inter-array cables. The offshore inter-array cables will have a voltage between 60 and 72.5 kV. The Brayton Point direct current (DC) offshore export cables will have a voltage of +-320 kV. The Falmouth variant offshore export cables will have an anticipated nominal voltage (AC or DC) of 200-345 kV for AC and +-525 kV for DC.

When electric energy is transported, a certain amount gets lost as heat, leading to an increased temperature of the cable surface and subsequent warming of the surrounding environment (OSPAR 2009). As described in Taormina et al. (2018), the only published field measurement study results are from the 166 MW Nysted wind energy project in the Baltic Sea (maximal production capacity of about 166 MW), in the proximity of two 33 and 132 kV AC cables buried approximately 1 m deep in a medium sand area. In situ monitoring showed a maximal temperature increase of about 2.5 ºC at 50 cm directly below the cable and did not exceed 1.4°C in 20 cm depth above the cable (Meißner et al., 2006). Taormina et al. caution that application of these results to other locations is difficult, considering the large number of factors affecting thermal radiation including cable voltage, sediment type, burial depth, and shielding. The authors note that the expected impacts of submarine cables would be a change in benthic community makeup with species that have higher temperature tolerances becoming more common. Taormina et al. conclude at the end of their review of available information on thermal effects of submarine cables that considering the narrowness of cable corridors and the expected weakness of thermal radiation, impacts are not considered to be significant. Based on the available information summarized here, and lacking any site-specific predictions of thermal radiation from the SouthCoast cables, we expect that any impacts will be limited to a change in species composition of the infaunal benthic invertebrates immediately surrounding the cable corridor. As such, we do not anticipate thermal radiation to change the abundance, distribution, or availability of potential prey for any species. As any increase in temperature will be limited to areas within the sediment around the cable where listed species do not occur, we do not anticipate any exposure of listed species to an increase in temperature associated with any of the cables.

To minimize EMF generated by cables, all cabling would be contained in electrical shielding (e.g., grounded metallic sheaths and steel armoring) to prevent detectable direct electric fields. SouthCoast Wind would also bury cables to a target burial depth of 6 feet wherever possible. Specifically, possible project burial depth range below level seabed would be 3-13 feet along export cable corridors and 3-8 feet along inter-array cables. The electrical shielding and burial are expected to control the intensity of EMF. However, magnetic field emissions cannot be reduced by shielding, although multiple-stranded cables can be designed so that the individual strands cancel out a portion of the fields emitted by the other strands. Normandeau et al. (2011) compiled data from a number of existing sources, including 19 undersea cable systems in the U.S., to characterize EMF associated with cables consistent with those proposed for wind farms. The dataset considers cables consistent with those proposed by SouthCoast Wind (i.e., up to 525 kV). In the paper, the authors present information indicating that the maximum anticipated magnetic field would be experienced directly above the cable (i.e., 0 m above the cable and 0 m lateral distance), with the strength of the magnetic field dissipating with distance. Based on this data, the maximum anticipated magnetic field would be 7.85 µT at the source, dissipating to 0.08 µT at a distance of 10 m above the source and 10 m lateral distance. In the BA, BOEM reports that EMF measurements of the Block Island Wind Farm cables showed a maximum reading of 8 mG, which was lower than the modeled EMF level of 22 mG (Shuman 2017 as cited in BOEM's BA). As noted in the BA, SouthCoast Wind modeled EMF levels from 60-Hz AC cables in the Project area (Appendix P1, SouthCoast Wind BA, 2023). The model estimated induced magnetic field levels from Project cables ranging from 85 milligauss for buried cables (6.6-foot) burial depth to 1,859 milligauss for unburied cables with cable protection (1-foot-thick [0.3-

meter-thick] concrete mattress) (COP Volume 1 and Appendix P1, SouthCoast Wind BA, 2023). The results suggested that at a distance of 10 feet from the cable center line, modeled EMF levels rapidly declined to 28.8 milligauss and 41.9 milligauss for buried and unburied cables (SouthCoast Wind BA, 2023). By comparison, the Earth's geomagnetic field strength ranges from approximately 20 to 75 μT (Bochert and Zettler 2006) and the estimated EMF level in the Project area is 512 to 514 milligauss (mG; 51.5 microteslas [μT]) (NOAA 2021).

Atlantic sturgeon
Sturgeons are electrosensitive and use electric signals to locate prey. Information on the impacts of magnetic fields on fish is limited. A number of fish species, including sturgeon, are suspected of being sensitive to such fields because they have magnetosensitive or electrosensitive tissues, have been observed to use electrical signals in seeking prey, or use the Earth's magnetic field for navigation during migration (EPRI 2013). Atlantic sturgeon have specialized electrosensory organs capable of detecting electrical fields on the order of 0.5 millivolts per meter (mV/m) (Normandeau et al. 2011).

Wyman et al. (2023) investigated the migration behaviors of adult green sturgeon in relation to the cable energization status (off/on) for a ±200 kilovolt direct current (DC) transmission line buried through a portion of the green sturgeon's spawning migration pathway in San Francisco Bay. Detection data collected along the migration route when the transmission line was energized and not energized allowed the authors to assess whether the energized cable - and by inference the magnetic field from its load - may have affected the green sturgeon's migratory behavior. Study results provided varied evidence for an association between cable status and migration behavior. For example, a higher percentage of inbound fish were able to successfully transit inbound after the cable was energized, but this effect did not reach the level of significance. Outbound fish took longer to transit when the cable was energized. Additionally, fish transiting along both inbound and outbound migration paths were not significantly influenced by the cable's energization status, but results suggest a potential subtle relationship between cable energization and the location of inbound and outbound fish migration paths. We note that the findings of Wyman et al. (2023) are not transferable to the proposed AC cables for the SouthCoast Wind project. This is because of differences in EMF fields generated by DC cable systems compared to EMF fields generated by AC cable systems. DC cable systems such as the one described in Wyman et al. (2023) generate static EMF fields in the vicinity of the cable route, while AC systems cause time-varying elliptic EMF fields (Lesur and Deschamps 2012). As a result, we expect biological responses to static (DC) or elliptic (AC) fields to be distinct.

Bevelhimer *et al*. 2013 examined the behavioral responses of Lake Sturgeon to electromagnetic fields. The authors also report on a number of studies, which examined magnetic fields associated with AC cables c and report that in all cases magnetic field strengths are predicted to decrease to near-background levels at a distance of 10 m from the cable. Like Atlantic sturgeon, Lake Sturgeon are benthic oriented species that can utilize electroreceptor senses to locate prey; therefore, they are a reasonable surrogate for Atlantic sturgeon in this context. Bevelhimer et al. 2013 carried out lab experiments examining behavior of individual lake sturgeon while in tanks with a continuous exposure to an electromagnetic source mimicking an AC cable and examining behavior with intermittent exposure (i.e., turning the magnetic field on and off). Lake sturgeon consistently displayed altered swimming behavior when exposed to the variable magnetic field. By gradually decreasing the magnet strength, the authors were able to identify a threshold level (average strength ~ 1,000–2,000 μT) below which short-term responses disappeared.

As described in the SouthCoast EMF modeling report, the magnetic field is expected to be undetectable at distances of 25 feet or greater from any portion of the cable. Background electrical fields in the action area are on the order of 1 to 10 mG from the natural field effects produced by waves and currents; this is several times higher than the EMF anticipated to result from the project's cables. As such, it is extremely unlikely that there will be any effects to Atlantic sturgeon due to exposure to the electromagnetic field from the proposed cable; therefore, effects are discountable

ESA-Listed Whales

The current literature suggests that cetaceans can sense the Earth's geomagnetic field and use it to navigate during migrations but not for directional information (Normandeau et al. 2011). It is not clear whether they use the geomagnetic field solely or in addition to other regional cues. It is also not known which components of the geomagnetic field cetaceans are sensing (i.e. the horizontal or vertical component, field intensity or inclination angle). Marine mammals appear to have a detection threshold for magnetic intensity gradients (i.e. changes in magnetic field levels with distance) of 0.1 percent of the earth's magnetic field or about 0.05 microtesla (μT) (Kirschvink 1990). Assuming a 50-mG (5 μT) sensitivity threshold (Normandeau 2011), marine mammals could theoretically be able to detect EMF effects from the inter-array and SouthCoast Wind export cables, but only in close proximity to cable segments lying on the bed surface. As described in the BA, modeling conducted for SouthCoast suggests that individual marine mammals would have to be within 10 feet or less of cable segments to encounter EMF above the 50-mG detection threshold.

As described in Normandeau et al. (2011), there is no scientific evidence as to what the response to exposures to the detectable magnetic field would be. However, based on the evidence that magnetic fields have a role in navigation it is reasonable to expect that any effects would be related to migration and movement. Given the limited distance from the cable that the magnetic field will be detectable, the potential for effects is extremely limited. Even if listed whales did avoid the corridor along the cable route in which the magnetic field is detectable, the effects would be limited to minor deviations from normal movements (approximately 10 feet). As such, any effects are likely to be so small that they cannot be meaningfully measured, detected, or evaluated and are therefore insignificant.

Sea Turtles

Sea turtles are known to possess geomagnetic sensitivity (but not electro sensitivity) that is used for orientation, navigation, and migration. They use the Earth's magnetic fields for directional or compass-type information to maintain a heading in a particular direction and for positional or hemap-type information to assess a position relative to a specific geographical destination (Lohmann et al. 1997). Multiple studies have demonstrated magneto sensitivity and behavioral responses to field intensities ranging from 0.0047 to 4000 μT for loggerhead turtles, and 29.3 to 200 μT for green turtles (Normandeau et al. 2011). While other species have not been studied, anatomical, life history, and behavioral similarities suggest that they could be responsive at similar threshold levels. For purposes of this analysis, we will assume that leatherback and Kemp's ridley sea turtles are as sensitive as loggerhead sea turtles.

Sea turtles are known to use multiple cues (both geomagnetic and nonmagnetic) for navigation and migration. However, conclusions about the effects of magnetic fields from power cables are still hypothetical, as it is not known how sea turtles detect or process fluctuations in the earth's magnetic field. In addition, some experiments have shown an ability to compensate for "miscues," so the absolute importance of the geomagnetic field is unclear.

Based on the demonstrated and assumed magneto sensitivity of sea turtle species that occur in the action area, we expect that loggerhead, leatherback, and Kemp's ridley sea turtles will be able to detect the magnetic field. As described in Normandeau et al. (2011), there is no scientific evidence as to what the response to exposures to the detectable magnetic field would be. However, based on the evidence that magnetic fields have a role in navigation it is reasonable to expect that effects would be related to migration and movement; however, the available information indicates that any such impact would be very limited in scope. As noted in Normandeau (2011), while a localized perturbation in the geomagnetic field caused by a power cable could alter the course of a turtle, it is likely that the maximum response would be some, probably minor, deviation from a direct route to their destination. Based on the available information, effects to sea turtles from the magnetic field associated with the SouthCoast cables are expected to be so small that they cannot be meaningfully measured, detected, or evaluated and are, therefore, insignificant.

Effects to Prey

Effects to forage fish, jellyfish, copepods, and krill are extremely unlikely to occur given the limited distance into the water column that any magnetic field associated with the cables is detectable. We have considered whether magnetic fields associated with the operation of the cables could impact benthic organisms that serve as sturgeon and sea turtle prey. A number of studies on the effects of exposure of benthic resources to magnetic fields are available. According to these studies, the survival and reproduction of benthic organisms are not thought to be affected by long-term exposure to static magnetic fields (Bochert and Zettler 2004, Normandeau et al. 2011; see also Snyder et al. 2019). A number of studies of benthic communities along submarine cables demonstrate little to no effect on benthic invertebrates following a short period of recovery (see for example Kraus and Carter 2018). Results from the 30-month post-installation monitoring for the Cross Sound Cable Project in Long Island Sound indicated that the benthos within the transmission line corridor for this project continues to return to pre-installation conditions. The presence of amphipod and worm tube mats at a number of stations within the transmission line corridor suggest construction and operation of the transmission line did not have a long-term negative effect on the potential for benthic recruitment to surface sediments (Ocean Surveys 2005). Therefore, no impacts (short-term or long-term) of magnetic fields on prey for any listed species in the action area are expected.

7.4.2 Lighting and Marking of Structures

To comply with FAA and USCG regulations, the WTGs and OSPs will be marked with distinct lettering/numbering scheme and with lighting. The USCG requires that offshore wind lessees obtain permits for private aids to navigation (PATON, see 33 CFR part 67) for all structures located in or near navigable waters of the United States (see 33 CFR part 66) and on the OSS. PATON regulations require that individuals or organizations mark privately owned marine obstructions or other similar hazards. The BA does not describe any additional buoys or markers that will be installed in association with the PATON.

During the operational period, offshore lighting will be limited to lights required for safety and occasional additional workboat lighting if there are maintenance activities that occur after dark. O&M lighting will be limited to the minimum necessary to ensure safety and compliance with applicable regulations. SouthCoast will also use Aircraft Detection Lighting System (ALDS) (or similar system), pursuant to approval by the FAA and commercial and technical feasibility at the time of FDR/FIR approval. Each WTG and OSP will be marked and lit with both USCG and approved aviation lighting. Given the height of lighting above the water surface, we do not expect that sea turtles, Atlantic sturgeon, whales, or their prey, will be attracted to the lights, or that there will be any changes in distribution or use of the lease area by any species due to the project lighting. As such, we have determined that any effects of project lighting on sea turtles, sturgeon, or whales are extremely unlikely and thus, discountable.

Lighting may also be required at on shore areas, such as where the cables will make landfall. These areas have existing lighting and any effects to ESA listed species from any increase in onshore lighting are extremely unlikely to occur and discountable. Sea turtle hatchlings are known to be attracted to lights and artificial beach lighting is known to disrupt proper orientation towards the sea. However, sea turtle nesting does not occur in New England; therefore, there is no potential for project lighting to impact the orientation of any sea turtle hatchlings in known nesting beaches.

7.4.3 WTG and OSP Foundations

The physical presence of structures in the water column has the potential to disrupt the movement of listed species but also serve as an attractant for prey resources and subsequently listed species. Structures may also provide habitat for some marine species, creating a reef effect. The foundations and generation of wind energy may affect the in-water and in-air conditions, which can result in changes to ecological conditions in the marine environment. Here, we consider the best available data that is currently available to address the potential effects on ESA listed species from the SouthCoast Wind project.

7.4.3.1 Consideration of the Physical Presence of Structures on Movements of Listed Species

The only wind turbines currently in operation in U.S. waters are the five WTGs that make up the Block Island Wind Farm and the two WTGs that are part of the Coastal Virginia Offshore Wind pilot project. Construction for the South Fork and Vineyard Wind 1 projects is currently underway, with a limited number of turbines operational at this time. We have not identified any reports or publications that have examined or documented any changes in listed species distribution or abundance at the Block Island or Virginia wind projects and have no information to indicate that the presence of these WTGs has resulted in any change in distribution of any ESA listed species.

As explained in Section 6 *Environmental Baseline*, the WFA is used by Atlantic sturgeon for migration and for opportunistic foraging. Consistent with information from other coastal areas that are not aggregation areas, we expect individual Atlantic sturgeon to be present in the WFA for short periods of time (<2 days; Ingram et al. 2019, Rothermal et al. 2020). Because Atlantic sturgeon carry out portions of their life history in rivers, they are frequently exposed to structures in the water such as bridge piers and pilings. There is ample evidence demonstrating that sturgeon routinely swim around and past large and small structures in waterways, often placed significantly closer together than even the minimum distance of the closest WTGs (see e.g., AKRF 2012). As such, we do not anticipate that the presence of the WTGs, OSPs, or the OCS-DC1 will affect the distribution of Atlantic sturgeon in the action area or their ability to move through the action area.

Given their distribution largely in the open ocean, whales and sea turtles may rarely encounter large fixed structures in the water column such as the turbine foundations; thus, there is little information to evaluate the effects that these structures will have on the use of the area by these species. Sea turtles are often sighted around oil and gas platforms and fishing piers in the Gulf of Mexico which demonstrates they do not have an aversion to structures and may utilize them to forage or rest (Lohoefener 1990, Rudloe and Rudloe 2005). Given the monopiles' large size (16 m diameter) and presence above and below water, we expect that whales and sea turtles will be able to visually detect the structures and, as a result, we do not expect whales or sea turtles to collide with the stationary foundations. Listed whales are the largest species that may encounter the foundations in the water column. Of the listed whales, blue whales are the largest species at up to 32.6 m. Based on the spacing of the foundations (1 x 1 nm grid) relative to the sizes of the listed species that may be present in the WFA, we do not anticipate that the foundations would create a barrier or restrict the ability of any listed species to move through the area freely.

While there is currently no before/after data for any of the ESA listed species that occur in the action area in the context of wind farm development, data is available for monitoring of harbor porpoises before, during, and after construction of three offshore wind projects in Europe. We consider that data here.

Horns Rev 1 in the North Sea consists of 80 WTGs laid out as an oblique rectangle of 5 km x 3.8 km (8 horizontal and 10 vertical rows). The distance between turbines is 560 m in both directions. The project was installed in 2002 (Tougaard et al. 2006). The turbines used at the Horns Rev 1 project are older geared WTGs and not more modern direct-drive turbines, which are quieter (Elliot et al. 2019; Tougaard et al. 2020). The Horns Rev 1 project has a smaller number of foundations to the SouthCoast Wind project (80 foundations in Hons Rev and 147 in SouthCoast Wind) but turbine spacing is significantly closer together (0.5 km compared to at least 1.8 km). Pre-construction baseline data was collected with acoustic recorders and with ship surveys beginning in 1999; post-construction acoustic and ship surveys continued until the spring of 2006. In total, there were seven years of visual/ship surveys and five years of acoustic data. Both sets of data indicate a weak negative effect on harbor porpoise abundance and activity during construction, which has been tied to localized avoidance behavior during pile driving, and no effects on activity or abundance linked to the operating wind farm (Tougaard et al. 2006).

Teilmann et al. (2007) reports on continuous acoustic harbor porpoise monitoring at the Nysted wind project (Baltic Sea) before, during, and after construction. The results show that echolocation activity significantly declined inside Nysted Offshore Wind Farm since the pre-construction baseline during and immediately after construction. Teilmann and Carstensen (2012) update the dataset to indicate that echolocation activity continued to increase as time went by after operations began. Thompson et al. (2010) reported similar results for the Beatrice Demonstrator Project, where localized (1-2 km) responses of harbor porpoises were found through PAM, but no long term changes were found. Scheidat et al. (2011) reported results of acoustic monitoring of harbor porpoise activity for one year prior to construction and for two years during operation of the Dutch offshore wind farm Egmond aan Zee. The results show an overall increase in acoustic activity from baseline to operation, which the authors note is in line with a general increase in porpoise abundance in Dutch waters over that period. The authors also note that acoustic activity was significantly higher inside the wind farm than in the reference areas, indicating that the occurrence of porpoises in the wind farm area increased during the operational period, possibly due to an increase in abundance of prey in this area or as refuge from heavy vessel traffic outside of the wind farm area. Teilmann and Carstensen (2012) discuss the results of these three studies and are not able to determine why harbor porpoises reacted differently to the Nysted project. One suggestion is that as the area where the Nysted facility occurs is not particularly important to harbor porpoises, animals may be less tolerant of disturbance associated with the operations of the wind farm. It is important to note that the only ESA listed species that may occur within the WFA that uses echolocation is the sperm whale. Baleen whales, which includes North Atlantic right whales, fin, blue, and sei whales, do not echolocate. Sperm whales use echolocation primarily for foraging and social communication (NMFS 2010, NMFS 2015, Miller et al. 2004, Watwood et al. 2006); sperm whales are expected to occur in low densities in the WFA due to the shallow depths and more typical distribution near the continental shelf break and further offshore. Sperm whale foraging is expected to be limited in the lease area because sperm whale prey occurs in deeper offshore waters (500-1,000m) (NMFS 2010). Therefore, even if there was a potential for the presence of the WTGs or foundations to affect echolocation, it is extremely unlikely that this would have any effect on sperm whales given their rarity in the WFA. Consideration of the effects of operational noise on whale communication is presented in Section 7.1 *Underwater Noise,* of this Opinion.

Absent any information on the effects of wind farms or other foundational structures on the local abundance or distribution of whales and sea turtles, it is difficult to predict how listed whales and sea turtles will respond to the presence of the foundations in the water column. However, considering just the physical structures themselves, given the spacing between the turbines we do not expect that the physical presence of the foundations alone will affect the distribution of whales or sea turtles in the action area or affect how these animals move through the area. Additionally, the available data on harbor porpoises supports the conclusion that if there are decreases in abundance during wind farm construction those are not sustained during the operational period. As explained in Section 7.1 *Underwater Noise,* we have determined that effects of operational noise will be insignificant and are not likely to disturb or displace whales, sea turtles, or Atlantic sturgeon. In the sections below, we consider the potential for the reef effect to affect species distribution in the WFA and the potential for the foundations and WTGs to affect habitat conditions and prey that could influence the abundance and distribution of listed species in the WFA.

7.4.3.2 Habitat Conversion and Reef Effect Due to the Presence of Physical Structures

As described in the BA, long-term habitat alteration would result from the installation of the foundations, scour protection around the WTG and OSP foundations as well as cable protection along any portions of the inter-array and export cables that could not be buried to depth.

The footprint of 147 WTGs foundations and 2 OSPs with piled jacket foundation types, monopoles, or suction jackets, and associated scour protection in the form of boulders and concrete mats would permanently modify approximately 390 acres of seabed. Please reference the table below for approximate acres of the seabed that would be permanently modified in order to protect the WTG foundations and OSPs.

Table 7.4.1.

Parameter - WTGs	Monopile	Piled Jacket	Suction Bucket Jacket
Permanent Footprint Area per WTG (including scour protection)	2.5 acres	2.6 acres	4.9 acres
Total Permanent Footprint Area (147 WTG foundations, including scour protection)	370.4 acres	383.7 acres	578.3 acres
Scour Protection Volume per WTG	36, 256 Cubic Yards	37,635 Cubic Yards	75, 583 Cubic Yards
Total Scour Protection Volume (147 WTGs)	5,329,632 Cubic Yards	5,532,345 Cubic Yards	8,757,925 Cubic Yards
Additional Temporary Disturbance from Seafloor Preparation During Construction per WTG	0.5 Acres	0.5 Acres	0.6 Acres
Total Additional Temporary Disturbance from Seafloor Preparation during Construction of (147 WTGs)	73.5 Acres	73.5 Acres	82.0 Acres
Parameter – OSPs (Maximum disturbance)	**Piled Jackets**		
Permanent Footprint Area per OSP (including scour protection)	9.8 Acres		

Total permanent Footprint Area (2 OSPs, including scour protection)	19.6 Acres
Scour Protection per OSP	157,193 Cubic Yards
Additional Temporary Disturbance from Seafloor Preparation During Construction per OSP	0.5 Acres
Total Additional Temporary Disturbance from Seafloor Preparation During Construction (2 OSPs)	1.0 Acres

Total values in the suction-bucket jacket column are calculated using the assumed maximum 85 suction-bucket jacket foundations are installed along with the 62 piled jacket foundations (for up to 147 WTGs). Source: Table 3.1-9 in SouthCoast Wind BA, 2024.

The addition of the WTGs and OSPs, spaced 1.0 nautical mile apart, is expected to result in a habitat shift in the area immediately surrounding each foundation type from soft sediment, open water habitat system to a structure-oriented system, including an increase in fouling organisms. Overall, construction of the SouthCoast Wind foundations, cables, and associated scour protection would transform soft bottom habitat into coarse, hard bottom habitat. -Over time (weeks to months), the areas with scour protection are likely to be colonized by sessile or mobile organisms (e.g., sponges, hydroids, crustaceans). This results in a modification of the benthic community in these areas from primarily infaunal organisms (e.g., amphipods, polychaetes, bivalves). Literature from Fonseca et al., 2024 examined effects of the Block Island Wind Farm with a focus on monitoring any changes to the benthic and epifaunal communities around the commercially operating WTGs. The study concluded that that there was a clear change to seabed sediments and the faunal community composition, but changes were only in the immediate footprint of WTG foundations (Fonseca et al, 2024). The research in this study also concluded that there was little evidence of a temporal or spastically pattern of change (as a function of distance away from turbines) in seabed physical and biological composition. Both conclusions here from Fonseca et al., 2024 suggest that benthic communities around WTGs could be in constant flux and that further studies should be examined at different spatial scales.

Hard-bottom and vertical structures in a soft-bottom habitat can create artificial reefs, thus inducing the ‘reef’ effect (Taormina et al. 2018). The reef effect is usually considered a beneficial impact, associated with higher densities and biomass of fish and decapod crustaceans in the area immediately surrounding the new structure (Taormina et al. 2018). This could provide a potential increase in available forage items for sea turtles compared to the surrounding soft-bottoms; however, this change in distribution/aggregation of some species does not necessarily increase overall biomass. In the North Sea, Coolen et al. (2018) sampled epifouling organisms at offshore oil and gas platforms and compared data to samples from the Princess

Amalia Wind Farm (PAWF) and natural rocky reef areas. The 60 PAWF monopile turbine foundations with rock scour protection were deployed between November 2006 and March 2007 and surveys were carried out in October 2011 and July 2013. This study demonstrated that the WTG foundations and rocky scour protection acted as artificial reef with a rich abundance and diversity of epibenthic species, comparable to that of a natural rocky reef.

Stenberg et al. (2015) studied the long-term effects of the Horns Rev 1 offshore wind farm (North Sea) on fish abundance, diversity, and spatial distribution. Gillnet surveys were conducted in September 2001, before the WTGs were installed, and again in September 2009, 7 years post-construction at the wind farm site and at a control site 6 km away. The three most abundant species in the surveys were whiting (*Merlangius merlangus*), dab (*Limanda limanda*), and sand lance (*Ammodytidae spp*.). Overall fish abundance increased slightly in the area where the wind farm was constructed but declined in the control area 6 km away. None of the key fish species or functional fish groups showed signs of negative long-term effects due to the wind farm. Whiting and the fish group associated with rocky habitats showed different distributions relative to the distance to the artificial reef structures introduced by the turbines. Rocky habitat fishes were most abundant close to the turbines while whiting was most abundant away from them. The authors also note that the wind farm development did not appear to affect the sand-dwelling species dab and sand lance, suggesting that the direct loss of habitat (<1% of the area around the wind farm) and indirect effects (e.g. sediment composition) were too low to influence their abundance. Species diversity was significantly higher close to the turbines. The authors conclude that the results indicate that the WTG foundations were large enough to attract fish species with a preference for rocky habitats, but not large enough to have adverse negative effects on species inhabiting the original sand bottom between the turbines. However, more research is still needed within offshore wind farm areas because each offshore wind farm area contains different environmental characteristics. For instance, research from Daewel et al. (2022) suggest changes in organic sediment distribution and quantity could have an effect on the habitat quality for benthic species such as Ammodytes spp. (e.g., sand lance) that live in the sediments within wind farm areas.

Methratta and Dardick (2019) carried out a meta-analysis of studies in Europe to examine finfish abundance inside wind farms compared to nearby reference sites. The overall effect size was positive and significantly different from zero, indicating greater abundance of fish inside of wind farm areas compared to the reference sites. More specifically, the study determined increases were experienced for species associated with both soft-bottom and complex-bottom habitat but changes in abundance for pelagic species were not significantly different from zero. The authors report that no significant negative effects on abundance were identified.

Hutchison et al. (2020) describes benthic monitoring that took place within the Block Island Wind Farm (BIWF, Rhode Island) to assess spatiotemporal changes in sediment grain size, organic enrichment, and macrofauna, as well as the colonization of the jacket foundation structures, up to four years post-installation. The greatest benthic modifications occurred within the footprint of the foundation structures through the development of mussel aggregations. Additionally, based on the presence of juvenile crabs (Cancer sp.),the authors conclude that the BIWF potentially serves as a nursery ground, as suggested from increased production rates for crabs (*Cancer pagurus*) at European OWFs (Krone et al., 2017). The dominant mussel community created three-dimensional habitat complexity on an otherwise smooth structure, benefiting small reef species such as cunner (*Tautogolabrus adspersus*), while at a larger scale, the turbine structures hosted abundant black sea bass (*Centropristis striata*) and other indigenous bentho-pelagic fish.

For the SouthCoast Wind project, effects to listed species from the loss of soft bottom habitat and conversion of soft bottom habitat to hard bottom habitat may occur if this habitat shift resulted in changes in use of the area (considered below) by listed species or resulted in changes in the availability, abundance, or distribution of forage species.

The only forage fish species we expect to be impacted by the loss of soft-bottom habitat would be sand lance (*Ammodytes spp.).* The ESA listed species in the WDA that may forage on sand lance include Atlantic sturgeon, fin, and sei whales. As sand lance are strongly associated with sandy substrate, and the project would result in a loss of such soft bottom, there would be a reduction in availability of habitat for sand lance that theoretically could result in a localized reduction in the abundance of sand lance in the action area. However, even just considering the WFA, which is dominated by sandy substrate, the loss or conversion of soft bottom habitat is very small, just over 0.3% (and an even smaller percentage of the action area). The results from Stenberg et al. (2015; summarized above) suggest that this loss of habitat is not great enough to impact abundance in the area and that there may be an increase in abundance of sand lance despite this small loss of habitat. However, even in a worst case scenario assuming that the reduction in the abundance of sand lance is directly proportional to the amount of soft substrate lost, we would expect a 0.3% reduction in availability of sand lance in the lease area and a 0.0001% reduction in the sand lance available as forage for fin and sei whales and Atlantic sturgeon in the action area. Given this small, localized reduction in sand lance and that sand lance are only one of many species the fin and sei whales and Atlantic sturgeon may feed on in the action area, any effects to these species are expected to be so small that they cannot be meaningfully measured, evaluated, or detected and are, therefore, insignificant.

Based on the available information (e.g., Methratta and Dardick 2019, Stenberg et al. 2015), we expect that there may be an increase in abundance of schooling fish in the WFA that sei or fin whales may prey on but that this increase may be a result of redistribution of species to the WFA rather than a true increase in abundance. Either way, at the scale of the action area, the effects of any increase in abundance of schooling fish resulting from the reef effect will be so small that the effects to sei or fin whales cannot be meaningfully measured, evaluated, or detected. Similarly, we expect that there may be an increase in jellyfish and other gelatinous organism prey of leatherback sea turtles but that at the scale of the action area, any effects to leatherback sea turtles will be so small that they cannot be meaningfully measured, evaluated, or detected. Because we expect sperm whale foraging to be limited in the WFA (due to the shallow depths and location inshore of the shelf break), any effects to sperm whale foraging as a result of localized changes in the abundance or distribution of potential prey items are extremely unlikely.

Atlantic sturgeon would experience a reduction in infaunal benthic organisms, such as polychaete worms, in areas where soft substrate is lost or converted to hard substrate. As explained above, the action area is not an aggregation area or otherwise known to be a high use area for foraging. Any foraging by Atlantic sturgeon is expected to be limited to opportunistic occurrences. Similar to the anticipated reduction in sand lance, the conversion of soft substrate to hard substrate may result in a proportional reduction in infaunal benthic organisms that could serve as forage for Atlantic sturgeon. Assuming that the reduction in the abundance of infaunal benthic organisms in the action area is directly proportional to the amount of soft substrate lost, we would expect an extremely small (0.3% of the lease area and an even smaller percentage of the total action area) reduction in the abundance of these species as forage for Atlantic sturgeon in the action area. Given that any reduction in potential prey items for Atlantic sturgeon will be small, localized, and patchy and that the WDA is not an area that sturgeon are expected to be dependent on for foraging, any effects to Atlantic sturgeon are expected to be so small that they cannot be meaningfully measured, evaluated, or detected and are, therefore, insignificant. Also, to the extent that epifaunal species richness is increased in the WFA due to the reef effect of the WTGs and their scour protection, and to the extent that sturgeon may feed on some of these benthic invertebrates, any negative effects may be offset.

The available information suggests that the prey base for Kemp's ridley and loggerhead sea turtles may increase in the action area due to the reef effect of the WTGs, associated scour protection, and an increase in crustaceans and other forage species. However, given the small size of the area impacted and any potential resulting increase in available forage, any effects of this patchy and localized increase in abundance are likely to be so small that they cannot be meaningfully measured, evaluated, or detected. No effects to the forage base of green sea turtles are anticipated as no effects on marine vegetation are anticipated.

No effects to copepods that serve as the primary prey for right whales are anticipated to result from the reef effect considered here. In Section 7.4.3.3 *Effects to Oceanic and Atmospheric Conditions due to Presence of Structures and Operation of WTGs*, we explain how the physical presence of the foundations may affect ecological conditions that could impact the distribution, abundance, or availability of copepods.

7.4.3.3 Effects to Oceanic and Atmospheric Conditions due to Presence of Structures and Operation of WTGs

As explained in Section 6.0 *Environmental Baseline,* the SouthCoast WFA is located within multiple defined marine areas and is directly southwest adjacent to Nantucket Shoals. Here, we consider the best available information on how the presence and operation of the up to 149 foundations supporting WTGs and OSPs proposed for the SouthCoast Wind project may affect the oceanographic and atmospheric conditions in the action area and whether there will be any consequences to listed species. As in the other sections of this Effects Analysis, we first identify the effects of the action and then determine if those effects are adverse (i.e., not wholly beneficial, insignificant, or discountable).

General Background Information on the Effects to Oceanic and Atmospheric Conditions due to Presence of Structures and Operation of WTGs

A number of theoretical, model-based, and observational studies have been conducted that help inform the potential effects offshore wind facilities may have on the oceanic and atmospheric environment; summaries of several of these studies, which represent the best available science on operational effects to oceanic and atmospheric conditions, are described in this section. In 2022, NMFS contracted with EA Engineering to prepare a literature review on this topic. Much of the information in this section of the Opinion is based on that review and is supplemented by additional scientific and commercial information that has become available since then. In general, most of these studies discuss local scale effects (within the area of a wind facility) and were carried out in Europe, specifically the North Sea, where commercial-scale offshore wind facilities are already in operation. At various scales, documented effects include increased turbulence, changes in sedimentation, decreased dissolved oxygen, and reduced water flow, as well as changes in hydrodynamics, wind fields, stratification, water temperature, nutrient upwelling, and primary productivity.

Due to the linkages between oceanography and food webs, lower-trophic level prey species that support listed species may be affected by changes in stratification and vertical mixing. There is limited information on which to base an assessment of the degree that the proposed project will result in any such impacts. At this time, the available observational information on the effects of the presence and operations of WTG or OSPs in U.S. Atlantic waters is limited to studies of benthic habitats and associated community changes in the vicinity of the Block Island Wind Farm and CVOW Pilot structures; these references are cited in other parts of this Opinion. Weather and hydrodynamic conditions were measured during the installation of two turbines installed offshore Virginia in the summer of 2020 (HDR 2020); however, no reports or literature about oceanographic or atmospheric impacts during operation of these two turbines have been published. Similarly, no reports or literature about oceanographic or atmospheric impacts during operation of the five turbines at the Block Island Wind Farm have been published. As described in the *Environmental Baseline*, the South Fork project entered the operational phase in 2024; offshore construction for the CVOW-C, Revolution Wind, and Vineyard Wind 1 projects is ongoing. At this time, there are not any available observational studies about the effects of any of these projects on oceanographic or atmospheric conditions. An observational physical oceanographic study to identify the influence of wind turbine foundations on water column stratification is currently in progress within the Vineyard Wind 1 WFA. Scientific instruments were deployed in late August 2024 and recovered in mid-October 2024; no results from this study are available yet. Therefore, at this time, there are no projects in coastal waters of the United States that can be used to evaluate potential impacts of the proposed SouthCoast Wind project. Thus, we have results from modeling studies of offshore wind development along the U.S. Atlantic coast and from modeling and observational studies conducted on offshore wind projects in other areas available to evaluate potential impacts on the oceanographic and atmospheric environment, and potential subsequent effects on ESA listed species and their prey.

Summary of Available Information on the Effects of Offshore Wind Facilities on Environmental Conditions

Effects on Water Temperature

A modeling study was conducted for the Great Lakes region of the U.S. to simulate the impact of 432 9.5 MW (4.1 GW total) offshore wind turbines on Lake Erie’s dynamic and thermal structure. Model results showed that the atmospheric wakes from wind turbines did have an impact on the area they were built in by demonstrating reduced wind speed and stress leading to less mixing, lower current speeds, and higher surface water temperatures (1-2.8°C, depending on the month). No changes to temperatures below the surface were reported (Afsharian et al. 2020). The authors note that these impacts were limited to the vicinity of the modeled wind facility. Though modeled in a lake environment, these results may be informative for predicting effects in the marine environment as the presence of structures and interactions with wind and water may act similarly; however, given the scale of the model and specificity of the modeled conditions and outputs to Lake Erie it is not possible to directly apply the results to an offshore wind project in the action area generally or the SouthCoast Wind project in particular.

Some literature is available that considers the potential impacts of wind power development on temperature. Miller and Keith (2018) developed a model to better understand climatic impacts due to wind power extraction; however, the paper addresses how a modeled condition would affect average surface temperatures over the continental U.S. and does not address offshore wind turbines or any effects on ocean water temperatures. Wang and Prinn (2010 and 2011) carried out modeling to simulate the potential climatic effects of onshore and offshore wind power installations; they found that while models of large scale onshore wind projects resulted in localized increases in surface temperature (consistent with the pattern observed in Miller and Keith 2018), the opposite was true for models of offshore wind projects. The authors found a local cooling effect, of up to 1°C, from similarly sized offshore wind installations. The authors provide an explanation for why onshore and offshore turbines would result in different localized effects.

Golbazi et al. 2022 simulated the potential changes to near-surface atmospheric properties caused by large offshore wind facilities equipped with 10 and 15 MW offshore wind turbines. In the model, they simulated 30 GW of offshore wind turbines located in identified lease and planning areas off the U.S. Atlantic coast. The model results show that, at hub height, an average wind speed deficit of 0.5 m/s extends up to 50 km downwind from the edge of the facilities with an average wind speed reduction at the surface that is 0.5 m s/1 or less (a 10% maximum reduction) within the project footprint. This results in a slight cooling, up to -0.06 K, at the surface in the summer. The authors conclude that, on average, meteorological changes at the surface induced by 10-15 MW offshore wind turbines will be nearly imperceptible in the summer. They also note that future research is needed to explore changes in other seasons.

Ocean-Atmosphere and Wind Field Interactions

Studies have examined the wind wakes produced by turbines and the subsequent turbulence and reductions in wind speed, both in the atmosphere and at the ocean surface. In general, as an air current moves towards and past a turbine, the structure reduces air velocities (reduced kinetic energy in the atmosphere) downstream and has the potential to generate turbulence near the ocean surface. This relative velocity deficit and increased turbulence near turbine structures create a cone-shaped wake of wind change (known as wind wake) in the downstream region from the turbine. Wind wakes vary in size and magnitude and vary based on natural environmental conditions (i.e., wind speed, direction) and turbine size and layout. Studies elucidating the relationship between offshore wind facilities and the atmospheric boundary layer, meteorology, downstream areas, and the interface with the ocean are still emerging. No in-situ/observational studies have been completed in the U.S. to date. Alterations to wind fields and the ocean–atmosphere interface have the potential to modify both atmospheric and hydrodynamic patterns, potentially on large spatial scales up to dozens of miles (~20+ km) from the offshore wind facility (Dorrell et al. 2022, Gill et al. 2020, Christiansen et al. 2022). Interactions between the ocean and the atmosphere in the presence of wind turbine structures are highly variable based on ambient wind speed, the degree of atmospheric stability, and the number of turbines in operation.

Generally, a wind energy facility is expected to reduce average wind speeds both upstream and downstream; however, studies report a wide range of values for average wind speed deficits, in terms of both magnitude and spatial extent. Wind wake propagation generally extends longer in stable atmospheric conditions where there is less influence from vertical mixing (Christiansen et al. 2022, Golbazi et al. 2022). Upstream of a large, simulated offshore wind facility, Fitch et al. (2012) found wind blocking effects to reduce average wind speeds by 1% as far as 9 miles (15 km) ahead of the facility. Downstream of an offshore wind facility, wind speeds may be reduced up to 46%, with wind wakes ranging from 3 to 43 miles (5 to 70 km) from the turbine or array (Christiansen and Hasager 2005; Carpenter et al. 2016; Platis et al. 2018; Cañadillas et al. 2020; van Berkel et al. 2020; Floeter et al. 2022). Wind speed deficit is greatest at hub height downstream of the facility, with the deficit decreasing closer to the ocean surface (Golbazi et al. 2022). While models and observations indicate that the maximum wind speed deficit occurs at hub height inside the wind wake downstream of an offshore wind energy facility, reduction in average wind speeds near the ocean surface has also been modeled and observed (Christiansen et al. 2022). Simulations of multiple, clustered, large offshore wind facilities in the North Sea suggest that wind wake may extend as far as 62 miles (100 km) (Siedersleben et al. 2018). On the U.S. northeast shelf, wind wakes emerging from simulations of full lease area buildouts with 15 MW WTGs (150 m hub height) were shown to combine and extend as far as 93 miles (150 km) on certain days (Golbazi et al. 2022). Wind speed reduction may occur in an area up to 100 times larger than the offshore wind facility itself (van Berkel et al. 2020). A recent study by ArcVera Renewables investigated long-range wind wake deficit potential in the New York Bight offshore development area using weather research and forecasting (WRF) offshore wind facility parameterization. The study determined that expert literature that used engineering wake loss models has under-predicted wind wakes; their study describes wind wakes that extend up to or greater than 62 miles (100 km) downstream of large offshore wind facilities (Stoelinga et al. 2022).

Model results have predicted reductions in surface winds and wind stress over tens of kilometers downwind from turbine arrays and these reductions may be influenced by closely adjacent wind farms (Christiansen et al. 2022). A study on the effect of offshore wind projects (~ 80 turbines) in Europe on the local wind climate using satellite synthetic aperture radar found that a decrease of the mean wind speed is found as the wind flows through the wind facility, leaving a velocity deficit of 8–9% on average, immediately downstream of the wind turbine arrays. Wind speed was found to recover to within 2% of the free stream velocity over a distance of 5–20 km past the wind facility, depending on the ambient wind speed, the atmospheric stability, and the number of turbines in operation (Christiansen & Hasager 2005). Christiansen et al. (2022) found that simulated wind wakes varied individually in size and intensity due to the different sizes of North Sea facilities and due to superposition of neighboring wakes, with the largest wind speed deficits modeled in densely built areas. Using an aircraft to measure wind speeds around turbines, Platis et al. (2018) found a reduction in wind speed within 10 km of the turbine.

Ocean-Atmosphere Responses to Wind Field Interactions

The disturbance of wind speed and wind wakes from wind facilities can cause oceanic responses such as upwelling, downwelling, and desertification (van Berkel et al. 2020; Dorrell et al. 2022; Floeter et al. 2022). In a modeling study of three offshore wind lease areas along the U.S. West Coast wind speed changes were found to reduce upwelling on the inshore side of windfarms and increase upwelling on the offshore side. These changes demonstrated that while the net upwelling in a wide coastal band changes relatively little, the spatial structure of upwelling within a coastal region can be shifted outside the bounds of natural variability (Raghukumar et al. 2023). Wave amplitude within and surrounding offshore wind energy facilities may be altered by changes to the wind field. A decrease in surface roughness can be observed in optical and radar images at considerable distances down-wind of an offshore wind facility under certain conditions (Forster 2018). According to Broström (2008), an offshore wind facility can cause a divergence/convergence in the upper ocean due to a strong horizontal shear in the wind stress and resulting curl of the wind stress. This divergence and convergence of wind wakes can cause upwelling and downwelling. Upwelling can have significant impacts on local ecosystems due to the influx of nutrient rich, cold, and deep water that increases biological productivity and forms the basis of the lower trophic level. Broström 2008 indicates that the induced upwelling by a wind facility will likely increase primary production, which may affect the local ecosystem. Oceanic response to an altered wind field is predicted to extend several kilometers around offshore wind facilities and to be strong enough to influence the local pelagic ecosystem (Broström 2008; Ludewig 2015; Floeter et al. 2022). Floeter et al. (2022) conducted the first observations of wind wake-induced upwelling/downwelling dipoles and vertical mixing downstream of offshore wind facilities in the North Sea. The study identified two characteristic hydrographic signatures of wind wake-induced dipoles. First, distinct changes in mixed layer depth and water column potential energy anomaly were observed over more than 3 miles (5 km). Second, the thermocline exhibited diagonal excursions, with maximum vertical displacement of 46 ft. (14 m) over a dipole dimension of 6–7 miles (10–12 km). Additionally, research by Daewel et al. (2022) suggests that ongoing offshore wind energy developments can have a significant impact on coastal marine ecosystems. This study deduced that wind wakes of large offshore wind energy clusters in the North Sea cause large-scale changes in annual primary production with local changes of up to 10%. These changes occur within the immediate vicinity of the offshore wind energy cluster and travel over a wider region (up to 1–2 km outside the cluster of projects).

The regional impact of wind wakes is challenging to quantify due to natural spatiotemporal variability of wind fields, sea levels, and local ocean surface currents in the northeast shelf (Floeter et al. 2022). Depending on the spatial orientation of the tidal ellipse in relation to the direction of the wind wake, the wake can either enhance or weaken the development of upwelling and downwell dipoles (Floeter et al. 2022). Offshore wind facilities may create a damming effect where a regional high pressure zone is created upwind of the turbines and air deflects up and over the turbine causing a low pressure zone in the middle. This air mass returns to the surface downstream of the turbine field, creating a dipole local high/low pressure zone on the ocean surface that can affect local currents including upwelling and downwelling (Christiansen et al. 2022). Increased airflow velocities near the water surface result in decreased water surface elevation of a 2-mm magnitude, while decreased airflow velocities result in increased water surface elevation of a similar magnitude in a different location (Christiansen et al. 2022a). This magnitude may be negligible in the context of the substantial year-to-year changes in annually averaged coastal sea level in the northeast shelf (i.e., 650 mm), which is attributed to the region's existing along-shelf wind stress (Andres et al. 2013; Li et al. 2014). Christiansen et al. (2022) modeled sea surface velocity changes downstream of multiple offshore arrays in the North Sea and found that induced changes equated to a "substantial" 10–25% of the interannual and decadal sea surface velocity variability in the region.

Hydrodynamic Interactions

The introduction of offshore wind energy facilities into ocean waters influences adjacent ocean flow characteristics (temperature, turbulence, suspended sediment), as turbine foundation structures and currents, tides, etc. interact. The dynamics of ocean flow past vertical structures has received relatively more study in well-mixed seas than in strongly stratified seas (Dorrell et al. 2022). The conditions in the SouthCoast WFA vary seasonally: during the winter the waters are generally well-mixed which persists through early spring with stratified conditions occurring through the summer with a strong thermocline at about 20 m depth; this stratification breaks down in late summer and into the fall (Lentz et al. 2003).

As water moves past WTG and OSP foundations, the structures generate a turbulent wake that will contribute to a mixing of the water column. The flow of water behind the foundation is affected through three main vortices, lee wake vortices, horseshoe vortices, and (vertical) counter-rotating vortices (Miles et al. 2017). The primary structure-induced hydrodynamic effects of wind turbine foundations are friction and blocking, which increase turbulence, eddies, sediment erosion, and turbidity in the water column (van Berkel et al. 2020). A number of studies have investigated the impacts of offshore wind facilities on stratification and turbulence (e.g. Carpenter et al. 2016, Schultz et al. 2020, Dorrell et al. 2022). These studies have demonstrated decreased flow and increased turbulence extending hundreds of meters from turbine foundations. However, the magnitude is highly dependent on the local conditions (e.g., current speed, tides, and wind speed), with faster flow causing greater turbulence and extending farther from the foundation. Using remote sensing, Vanhellemont and Ruddick (2014) demonstrated a significant increase in suspended sediments in the wake of individual turbine monopiles in offshore wind farms in the southern North Sea. In-water wakes of suspended sediment extended from individual foundations in the same direction as tidal currents, extending 30–150 m wide, and several kilometers in length. However, the authors indicate the environmental impact of these wakes and the source of the suspended material were unknown (i.e., it was noted that if material was eroded at the base of the turbine, additional scour protection might be required). Potential effects from an increase in suspended sediment could include decreased underwater light field, sediment transport, and downstream sedimentation which could affect primary production (Vanhellemont and Ruddick 2014).

Several studies have examined the effects the foundation structures have on ocean turbulence and stratification; monopiles were found to increase localized vertical mixing due to the turbulence from the in-water wakes generated from the foundations, which in turn could decrease localized seasonal stratification and could affect nutrient cycling on a local basis. Floeter et al. 2017 summarized modeling and remotely sensing studies documenting wakes with a length of 1,000 m of each foundation and other variables, including changes in current speed. Using both observational/field and modeling methods to study impacts of foundations on turbulence, Schultze et al. (2020) found that strong turbulence remained within the first 100 m from the foundation and reached at least 300 m under a range of stratified conditions. Field measurements at the offshore wind facility DanTysk in the German Bight of the southern North Sea observed a wake area 70 m wide - over 10 times the diameter of the foundation (D = 6 m), and 300 m long, approximately 50 times the diameter of the foundation, from a single monopile foundation during weak stratification (0.5°C surface-to bottom temperature difference). Schultze et al. (2020) also notes that in weak stratified conditions, the disturbance (turbulence) of the water column caused by the wake from the foundation reached at least 450 m downstream before restratification began. In a laboratory setting, Miles et al. (2017) found that the mean flow in the wake of a foundation recovered to within 5% of background levels values in an average of 8.3 D (where D is the diameter of the foundation) and to full flow by approximately 11 D. In this experiment, the background flow rate was 0.25 m/s. Dorrell et al. (2022) analyzed the potential for mixing of stratified conditions downstream of a foundation, citing Reynolds number dependence they note length of in-water wakes could reach D = 50. These studies generally conclude that foundation-induced mixing may locally account for a 7 - 10% increase in mixing above typical bottom boundary layer mixing processes (Miles et al. 2021).

Carpenter et al. (2016) used a combination of numerical models and in situ measurements from two wind facilities (Bard 1 and Global Tech 1, both in the North Sea) to conduct an analysis of the impact of increased mixing in the water column due to the presence of offshore wind structures on the seasonal stratification of the North Sea. Based on the model results and field measurements, estimates of the time scale for how long a complete mixing of the stratification takes was found to be longer, though comparable to, the summer stratification period in the North Sea. The authors concluded that it is unlikely the two wind facilities would alter seasonal stratification dynamics in the region. The estimates of mixing were found to be influenced by the pycnocline thickness and drag of the foundations of the wind turbines. The authors noted that for there to be a significant impact on stratification from the hydrodynamic impacts of turbine foundations over a large area, large regions (length of 100 km or more) of the North Sea would need to be covered with wind turbines; however the actual threshold was not defined (Carpenter et al. 2016). Schultz et al. 2020 found similar results in the same area of the German Bight of the North Sea.

Impacts on stratification and turbulence could lead to changes in the structure, productivity, and circulation of the affected oceanic regions; however, the scale and degree of those effects is dependent in part on location. Stratification is an important component of the ecosystem, as zooplankton may move between warm waters to feed and cool water to avoid predators. In areas of oceanographic fronts, the physical structure of wind turbine foundations (i.e., the foundation structure itself) may alter the structure of fronts, which could affect distribution of prey and lead to effects to the marine vertebrates that use these oceanic fronts for foraging (Cazenave et al. 2016). As areas of frontal activity are often pelagic biodiversity hotspots, altering their structure may decrease efficient foraging opportunities for some species. In relation to the role of tides in wake-induced hydrodynamic perturbations, Christiansen et al. (2022) found that tide-related hydrodynamic features (e.g., currents and fronts) influence the development of wake effects in the coastal ocean. Tidal currents were found to be able to counter changes in horizontal surface currents and in shallower waters, tidal stirring influences how wake effects translate to changes in vertical transport and density stratification (Christiansen et al. 2022). In an empirical biophysical study, Floeter et al. (2017) used a remotely operated vehicle to record conductivity, temperature, depth, oxygen, and chlorophyll-a measurements of an offshore wind facility in the North Sea. Vertical mixing was found to be increased within the footprint of the wind facility, leading to a doming of the thermocline and a subsequent transport of nutrients into the surface mixed layer. Though discerning a wind facility-induced relationship from natural variability is difficult, wind facilities may cause enhanced mixing, and due to the interaction between turbulence levels and the growth of phytoplankton, this could have cascading effects on nutrient levels, ecosystems, and marine vertebrates (Carpenter et al. 2016, Floeter et al. 2017).

Van Berkel et al (2020) investigated available information on the effects of offshore wind facilities on hydrodynamics and implications for fish; we note that the study did not evaluate effects to zooplankton. The authors report that changes in the demersal community have been observed close to wind facilities (within 50 m) and that those changes are related to structure-based communities at the foundations (e.g., mussels). The authors also report on long-term studies of fish species at the Horns Rev project (North Sea) and state that no significant changes in abundance or distribution patterns of pelagic and demersal fish have been documented between control sites and offshore wind energy facilities or inside/between the foundations at wind facilities. They report that any observed changes in density were consistent with changes in the general trend of species reflected in larger scale stock assessment reports (see also Stenberg et al. 2015).

Modeling experiments have demonstrated that the introduction of monopiles could have an impact on the M_2 amplitude (semidiurnal tidal component due to the moon) and phase duration. Modeling showed the amplitude increased between 0.5-7% depending on the location of the local preexisting amphidrome, defined as the geographical location, which has zero tidal amplitude for one harmonic constituent of the tide (Cazenave et al. 2016). Changes in the tidal amplitude may increase the chances of coastal flooding in low-lying areas. However, we have no information to suggest that any potential effects on M_2 amplitude would have any effects on marine resources generally or ESA listed species specifically.

The National Academies of Sciences, Engineering, and Medicine's "Potential Hydrodynamic Impacts of Offshore Wind Energy on Nantucket Shoals Regional Ecology: An Evaluation from Wind to Whales" report considered the potential for offshore wind facilities in the Nantucket Shoals region to affect oceanic physical processes and how hydrodynamic alterations may affect the local to regional ecosystem, particularly North Atlantic right whale foraging and prey resources (NASEM 2023). The findings in the report acknowledge that offshore wind energy development may impact oceanic physical processes that influence right whales through the abundance and distribution of their prey, but note significant uncertainty in the potential impacts from offshore wind development. The report includes a number of recommendations for additional observational research and modeling studies to be conducted at the turbine, wind farm, and regional scales (NASEM 2023). The report noted that the magnitude of potential hydrodynamic effects from regional-scale offshore wind development may be difficult to discern relative to ongoing climate induced changes and natural variability. We note that this does not necessarily mean that impacts from offshore wind development will be non-significant or not detectable and that they may be incremental as additional development occurs. We also acknowledge that changes to the southern New England ecosystem that may result from offshore wind development may be difficult to discern from those attributable to climate change particularly absent a robust monitoring strategy.

The Johnson et al. 2021 report "Hydrodynamic Modeling, Particle Tracking and Agent-Based Modeling of Larvae in the U.S. Mid-Atlantic Bight" was evaluated as a reference, however, we note key concerns with the report and do not consider it the best available information relative to the other sources cited herein. These concerns include poor model validation, over-reliance on “normal” conditions and mean values, poor model assumptions and flaws in the model design, insufficient context and references, and conclusions that contradict the findings detailed in the report. Furthermore, the study did not assess the impact on the distribution of copepods, a key zooplankton species in the ecosystem.

Primary Production and Plankton Distribution

The influence of altered atmospheric and hydrodynamic turbulence on the vertical mixing of the water column may impact the delivery of nutrients to the euphotic zone, the upper layer of the water column that receives sufficient light penetration for photosynthesis, and which generally occurs within the upper 100–170 ft. (30–52 m) of the water column in the northeast shelf (Ma and Smith 2022). Seasonal mixing of the water column provides nutrients to support phytoplankton growth, with primary production at deeper depths being limited by lack of sunlight (Dorrell et al. 2022). As water flows around foundations, aggregations of planktonic prey may be dispersed due to the increased mixing caused by water moving around foundations; however, water flowing around turbine foundations may also cause eddies to form, potentially resulting in more retention of plankton in the region when combined with daily vertical migration of the plankton (Chen et al. 2016, Nagel et al. 2018, Dorrell et al. 2022). However, it is important to note that these conclusions from Chen et al. (2016) are hypothesized based on a larval transport modeling study and no studies to document these predictions have been carried out to date in southern New England and there is little research available on the extent of eddies. Under stratified conditions, layering in the in-water wake of the turbine foundations may occur where water moves around the foundation and multiple layers of different density gradients form. This in turn may cause alterations to the structure of the water column (Dorrell et al. 2022). The potential for increased mixing may also increase nutrient availability and therefore increase phytoplankton growth/primary production (Daewel et al. 2022). However, reduced wind stress due to farther field atmospheric wakes could also cause reduced mixing and subsequently affect the exchange of nutrients and heat between water depths, and subsequently affect prey.

A few studies have been conducted to evaluate how altered hydrodynamic patterns around offshore wind projects could affect primary production as well as upper trophic levels. Floeter et al., 2017 demonstrated with empirical data from the southern North Sea that increased vertical mixing at an offshore wind facility resulted in the transport of nutrients to the surface mixed layer and subsequent uptake by phytoplankton in the photic zone. Increased primary production could increase the productivity of bivalves and other macrobenthic suspension feeders that are expected to be a major component of artificial reef communities that form on turbine foundations (Slavik et al., 2019, Mavraki et al., 2020; Daewel et al. 2022). The results of analyses conducted by Floeter et al. 2017 and Friedland et al. 2021 suggest that effects on phytoplankton and zooplankton might extend to upper trophic level impacts, potentially modifying the distribution and abundance of finfish and invertebrates. The spatial scale of these effects remains unknown but could range from localized within individual facilities to broader spatial scales (Carpenter et al., 2016; Bakhoday-Paskyabi et al., 2018).

Wang et al. 2018 evaluated pre and post-construction water column properties (water temperature, dissolved oxygen, and suspended matter concentration) and zooplankton community structure at an offshore wind facility in China. The facility consisted of 70 WTGs (232 MW total) located in the intertidal zone less than 11 km from the shore in the Yellow Sea. The goal of this study was to examine the responses of the zooplankton community to the establishment of an offshore wind facility, the causes of any observed effects, and their relation to environmental factors in the study area. The analysis documented changes in the zooplankton community (e.g., seasonal increases and decreases in macro and microzooplankton). However, given that there are significant differences in the location and conditions between the site in China and the SouthCoast WFA (e.g., tidal flat/intertidal zone vs. offshore) and the layout of the site (WTGs are much closer together at the China site) it is not clear that the results of this study will be informative for the SouthCoast Wind project.

Daewel et al. 2022 used modeling to demonstrate the effects of wind wake from offshore wind projects in the North Sea on primary productivity. The model results show that the systematic modifications of stratification and currents alter the spatial pattern of ecosystem productivity; annual net primary production (netPP) changes in response to offshore wind facility wind wake effects in the southern North Sea show both areas with a decrease and areas with an increase in netPP of up to 10%. There was a decrease in netPP in the center of the large offshore wind facility clusters in the inner German Bight and at Dogger Bank, which are both situated in highly productive frontal areas, and a netPP increase in areas around these clusters in the shallow, near-coastal areas of the German Bight and at Dogger Bank. The authors note that additional work is needed to identify the robustness of these patterns with respect to different weather conditions and interannual variations. They also note that when integrated over a larger area, the estimated positive and negative changes tend to even out. Besides the changes in the pelagic ecosystem, the model results highlight a substantial impact on sedimentation and seabed processes. The overall, large-scale reduction in average current velocities results in reduced bottom-shear stress to up to 10% locally; however, averaged over larger areas the effect is less pronounced with only a 0.2% increase North Sea wide. The model also indicates an impact of an offshore wind facility on bottom water oxygen in the southern North Sea. In an area with a bathymetric depression (Oyster Grounds), the dissolved oxygen concentrations in late summer and autumn were further reduced by about 0.3 mg l^{-1} on average and up to 0.68 mg l^{-1} locally. In other areas of the southern North Sea, the effect was estimated to be less severe, or even showing an increase in dissolved oxygen concentration, along the edges of Dogger Bank for example (Dawel et al. 2022).

Consideration of Potential Effects of the SouthCoast Wind Project

Here, we consider the information in the *Environmental Baseline*, incorporate the layout and parameters of the SouthCoast Wind project and the local oceanographic and atmospheric conditions, and apply the scientific information described above to evaluate effects anticipated to result from the presence of the foundations supporting the WTGs and OSPs and the operation of the WTGs, addressing both far-field and near-field effects and considering how those effects will in turn affect biological resources, in particular the prey of ESA listed species in the action area. We then consider the effects to listed species.

In general, the studies referenced above describe varying scales of impacts on the oceanographic and atmospheric processes as a resultant effect of the presence and operation of offshore wind turbine generators and/or their foundations. These impacts include increased turbulence generated by the presence of foundations, extraction of wind/kinetic energy by turbine operations reducing surface wind stress and altering water column turbulence, and upwelling and downwelling caused by the divergence and convergence of wind wakes (Miles et al. 2021). The best available information, as cited above, indicates that oceanographic and atmospheric effects are possible at a range of temporal and spatial scales, based on regional and local oceanographic and atmospheric conditions as well as the size and locations of wind facilities. However, discerning a wind facility-induced relationship from natural variability and climatic changes is difficult and very specific to local environmental conditions where the offshore wind project is located. As described above, the particular effects and magnitudes can vary based on a number of parameters, including model assumptions and inputs, study site, oceanographic and atmospheric conditions, turbine size, and wind facility size and orientation (Miles et al. 2021). Based on observed and modeled results described in the summary of the best available information above, we do expect effects to occur, but acknowledge there is uncertainty regarding the scale/magnitude and extent of these effects in the context of the southern New England ecosystem and in the SouthCoast Wind lease area and surrounding area specifically. The best available information suggests that some impacts require very large scale wind development before they would be realized (e.g. Schultze et al. 2020); as such, we note that the conclusions reached here are specific to the scope of the SouthCoast Wind project (up to 149 foundations supporting WTGs [maximum hub height of 184 m above mean lower low water] and OSPs) and its specific geographic location in consideration of the *Environmental Baseline*, which takes into consideration the presence and operation of the operational South Fork project, the Revolution Wind and Vineyard Wind 1 projects that are under construction, and the Sunrise Wind and New England Wind projects, for which construction has not begun but ESA consultation has been completed. We consider this suite of projects because they are all located within the southern New England region with proximity to the SouthCoast WFA where effects from these collective projects may influence one another, and as explained in the *Environmental Baseline* of this Opinion, are part of the baseline for the SouthCoast project. Other offshore wind projects located in the Mid-Atlantic that are considered in the *Environmental Baseline* are too far away for effects from those projects or ones from the SouthCoast project to interact. We also note that the analysis and conclusions reached here may not be reflective of the consequences of larger scale offshore wind development in the region or even a single project in a different location.

In summary, results of in-situ research, and modeling and simulation studies, show that offshore wind facilities can reduce wind speed and wind stress which can lead to less mixing, lower current speeds, and variations in surface water temperature (Afsharian et al. 2020); increase localized vertical mixing due to the turbulence from the wakes produced from water flowing around turbine foundations (Miles, Martin, and Goddard 2017, Schultz et al. 2020); cause wind wakes that will result in detectable changes in vertical motion and/or structure in the water column (upwelling and downwelling) (Christiansen & Hasager 2005, Broström 2008, Floeter 2022); induce changes in primary productivity (Daewel et al. 2022); and result in detectable sediment wakes downstream through increased turbidity (Vanhellemont and Ruddick, 2014). We have considered if these impacts could result in disruption of prey aggregations, primarily of planktonic organisms transported by currents such as copepods and gelatinous organisms (e.g., salps, ctenophores, and jellyfish medusa).

As described in the *Environmental Baseline*, southern New England and specifically the area in and around the SouthCoast WFA is a biologically and ecologically important area for multiple taxa, including ESA listed marine mammals and sea turtles (Estabrook et al. 2022, O'Brien et al. 2022, Van Parijs et al. 2023, Rider et al, 2024). These species occur seasonally throughout the year, with some exhibiting year round occurrence, and use the waters for a variety of life history functions, including migrating, foraging, resting, and socializing (Quintana-Rizzo et al. 2021). The southern New England region is defined by Nantucket Shoals, which is a dynamic bathymetric feature, which coupled with regional oceanography, serves to aggregate prey on and around the Shoals for marine mammals, sea turtles, birds, and other marine species to forage. The SouthCoast lease area is directly southwest adjacent to Nantucket Shoals. Currents flow over and around the Shoals creating frontal activity, which serves to transport and aggregate prey. The region is well mixed with colder water temperatures in the winter with stratification and warmer surface waters setting up through the spring, the region experiences stratification through the summer until it breaks down in the fall (Lentz et al. 2003). Listed species prey on a variety of species in the region, zooplankton and forage fish being two of the most dominant. The zooplankton community is diverse, with some species advected into the region from the northern latitudes while some are resident species. The area has become a core foraging area for North Atlantic right whales during winter and spring seasons. Since approximately 2010, North Atlantic right whales have continually increased their habitat use of the southern New England region and specifically the waters around Nantucket Shoals (Meyer-Gutbrod et al. 2021). Right whales have been observed throughout the year and between the 2011-2019 study periods analyzed in Quintana-Rizzo et al. (2021), 87% of the current population had been sighted in southern New England and the discovery curve suggested an open population or that sightings in the area were underestimated. Between 2010 to 2022, sightings of all age and sex classes (male, female, adult, juvenile, and calves) have increased in the region with sightings of adult males and adult non-reproductive females tripling over this period. During this same time period, the proportion of reproductive females sighted in southern New England has increased as well (Quintana-Rizzo et al. 2021). These findings highlight the importance of this area for North Atlantic right whales, which as established throughout this Opinion are highly stressed.

Summary of Environmental Conditions in the SouthCoast WFA

The SouthCoast lease area is oriented northeast to southwest and spans an area deepening across the shelf from approximately the 40 to 60 m isobaths. Data from the SouthCoast meteorological oceanographic buoy (deployed from 2020-2022, the buoy was first deployed adjacent to the Lease Area's northeast boundary for half a year and then relocated to the middle of the northeast third of the lease year for a year and a half) show wind direction is primarily from the northwest during winter, spring, and fall and from the southwest in the summer, with an average wind speed of about 6.5 m/s at 4-m height (SouthCoast Wind COP Appendix F4). Data from the buoys demonstrates the rotary nature of currents, which recorded currents rotating clockwise around a full ellipse, with a high tide and a low tide on a semi-diurnal basis (approximately twice a day). Current speed on average was 0.246 meters/second (m/s) at 10 m and 0.239 m/s at 30 m.

Currents show some variability due to season, tides, winds, and bathymetry and were found to be strongest during the winter. Net flow direction was estimated to be NNW – SSE and indicate that water mass traversal time from one side of the SouthCoast Wind lease area to the other is an average of 4-6 days (SouthCoast Wind COP Appendix F4).

Far-Field Atmospheric and Oceanographic Effects from the SouthCoast Wind Project
The spinning of WTG blades and the extraction of kinetic energy from the atmosphere may cause far-field effects that have the potential to reduce wind stress and thus less wind energy to mix the ocean surface boundary layer, which may decrease mixing of the water column. These farther field effects will primarily occur in the lee/downstream of the predominant wind direction, however, presence of the WTGs and their spinning blades may create a damming effect where a regional high pressure zone is created upwind of the turbines and air deflects up and over the turbine causing a low pressure zone in the middle. This air mass returns to the surface downstream of the turbine field, creating a dipole local high/low pressure zone on the ocean surface which can affect local currents including upwelling and downwelling (Christiansen et al. 2022). Under stable conditions (i.e. sustained wind speed from a consistent direction), farther-field atmospheric effects may occur upwards of 100 km downwind of the SouthCoast WFA, but the strongest impacts will likely be within 5-30 km (i.e. Christiansen and Hasager 2005, Gill et al. 2020, Christiansen et al. 2022, Floeter et al. 2022, Golbazi et al. 2022). From studies in the North Sea, these effects may include reduced wind speeds and wind stress and alterations to depth-averaged velocity, salinity, and sea-surface elevation (Christiansen et al. 2022). However, hub height of turbines (where strongest wind speed reductions emerge) and local ambient conditions (variability in conditions) may influence the extent of these effects. Changes in mixed layer depth and thermocline conditions due to atmospheric wake effects have been observed extending up to 12 km between the paired upwelling peak and downwelling patterns (dipole) at one wind facility with the upwelling and downwelling extending approximately 20 km from the wind facility (Floeter et al. 2022). Similar effects on mixed layer depth and thermocline conditions due to reduced wind speed and wind stress, which can lead to less mixing, lower current speeds, and variations in surface water temperature, may occur in the lee of the SouthCoast WFA when the wind direction is consistent (Afsharian et al. 2020). Alterations to wind fields and the ocean–atmosphere interface, including detectable changes in vertical motion and/or structure in the water column (upwelling and downwelling), have also been modeled, with modeling predicting modifications to both atmospheric and oceanographic patterns on large spatial scales of up to tens of kilometers (Christiansen and Hasager 2005, Broström 2008, Gill et al. 2020, Floeter 2022, Christiansen et al. 2022). As noted above, oceanic response to an altered wind field is predicted to extend greater than several kilometers around offshore wind facilities and to be strong enough to influence the local pelagic ecosystem (Brostrom 2008, Ludewig 2015, Floeter et al. 2022).

As noted above, the operation of WTGs may reduce wind stress and thus there may be less wind energy to mix the ocean surface boundary layer, which could result in effects to the timing and rate of breakdown of stratification in the fall, which could have cascading effects on species in the region. At a local scale, the southern New England region, primarily the deeper waters to the west and south of Nantucket Shoals, are seasonally stratified during the spring, summer, and early fall affecting productivity. When applying studies conducted outside southern New England and the greater Mid-Atlantic Bight region to our consideration of the potential effects of the SouthCoast Wind project on oceanographic and atmospheric conditions, it should be noted that the seasonal stratification over the summer, particularly in the studies conducted in the North Sea, is much less than the peak stratification seen in the summer in southern New England and the greater Mid-Atlantic Bight region (Castelao et al. 2010). The conditions in the North Sea are more representative of weaker stratification, similar to conditions seen in southern New England and the Mid-Atlantic Bight during the spring or fall (van Leeuwen et al. 2015). Because of the weaker stratification during the spring and fall, the Mid-Atlantic Bight and southern New England waters may be more susceptible to changes in mixing as well as hydrodynamic impacts due to the presence of structures and potential for increased turbulence during this period when waters are more unstable than during highly stratified conditions in the summer (Kohut and Brodie 2019, Miles et al. 2021). However, as described above, the available information (e.g. Carpenter et al. 2016, Schultz et al. 2020) indicates that in order to see significant impacts on strong stratification, large regions would need to be covered by wind turbines. North Atlantic right whale habitat use of southern New England is lowest in the summer months when stratification is at its peak, however, fin whales and listed sea turtles are common throughout the region in the summer. SouthCoast Wind applied their project parameters (e.g. WTG rotor diameter and hub height) and meteorological buoy data to assess the potential effect of wind wakes on stratification. They found that wind wake deficits are greatest just behind a WTG at hub height. These effects extend downwind and towards the sea surface, but at reduced wind speed deficits than at hub height (SouthCoast Wind COP Appendix F4). The SouthCoast Wind analysis provided in the COP Appendix focuses on the effects from a single WTG out to a distance of 10 km at which wakes were estimated to dissipate to 5% of the initial wind speed or less. At this time, we do not find that the available information would support a conclusion that presence and operations of SouthCoast Wind project structures and WTGs, in addition to the other permitted offshore wind projects in the action area, would cause increased mixing to the magnitude that would affect the timing and rate of the formation or breakdown of the Cold Pool or broader seasonal stratification in southern New England in the spring and fall, respectively, thus we do not expect any changes in the broader regional stratification to result in adverse effects on ESA listed species.

Based on the best available information as cited herein, we do not expect the scope of oceanographic, atmospheric, or hydrodynamic effects from the proposed SouthCoast Wind project to be large enough to influence regional conditions that could significantly affect the biomass of prey, mainly zooplankton, in the region. We expect individual turbine/near-field effects to be the primary drivers of changes in zooplankton distribution with potential effects occurring due to far-field effects from energy extraction in the lee of the WFA. We expect impacts to oceanographic conditions to extend tens of kilometers from the outermost rows of foundations in the SouthCoast Wind lease area that would vary directionally based on the direction of the wind and flow of water (Gill et al. 2020, Christiansen et al. 2022, Floeter et al. 2022). However, based on the available information presented above and the location of the SouthCoast WFA relative to the predominant westward flow of water in the southern New England region during the time of year when right whales are more likely to be present and foraging (winter and spring), we do not expect the impacts to oceanic conditions resulting from the SouthCoast Wind project to affect the oceanographic forces transporting plankton into the area from the Gulf of Maine or offshore; however, there may be effects on the distribution of zooplankton due to near-field effects (as addressed further below). Nor do we expect the construction and operation of the SouthCoast Wind project to alter the broad current patterns in southern New England, however, residence time of water within the WFA may increase due to the presence of structures and operation of WTGs and potentially slow the transport of water (and thus prey) to the west (Carpenter et al. 2016, van Berkel et al. 2020). However, we expect any alteration of the biomass of plankton in the region, and change in the total food supply, to be so small that adverse effects on ESA listed species are not reasonably certain to occur.

Given that the predominant wind direction in the SouthCoast WFA is from the northwest and southwest depending on time of year, with an average wind speed of about 6.5 m/s at 4-m height (SouthCoast Wind COP Appendix F4), under stable atmospheric conditions, we would expect any farther field effects (changes to stratification and mixed layer depth, transport of prey) to most commonly occur northeast of the SouthCoast WFA and to the east-southeast in lease area OCS-A 0522 (and potentially beyond that lease area). The SouthCoast WFA is directly southwest of Nantucket Shoals and directly west/northwest of lease area OCS-A 0522. Conditions are not expected to return to ambient between adjacent wind projects (Christiansen et al. 2022). During persistent wind from the northwest/west, atmospheric wake effects from the Vineyard Wind 1 project and the New England Wind project may overlap with the SouthCoast WFA and thus could reduce wind speed reaching the SouthCoast Wind project, which would result in further reduced wind speeds in the lee of the SouthCoast Wind project in the area of lease area OCS-A 0522. These far-field effects may also alter the tidal flow on-to and off-of Nantucket Shoals, which could influence characteristics of the tidal front in that region (Christiansen et al. 2022). Alterations to the tidal flow and tidal front could modify the mechanisms that aggregate zooplankton and also primary productivity and thus the nutrient supply for plankton/zooplankton. Regional distribution of plankton may vary from pre-wind facility conditions due to the reduced flow within the WFA and potential for increased residence time. However, based on our consideration of the available information, relative to far-field effects of the SouthCoast Wind project, we do not anticipate disruption to conditions that would aggregate prey in or outside the WFA nor do we expect changes in the overall abundance of prey in or outside the WFA that would result in adverse effects on ESA listed species. However, as noted above during stable conditions, far-field atmospheric wake effects from the SouthCoast Wind project could influence characteristics (i.e. reduction in residual flow, changes in the mean location of the front, changes in the vertical transport of nutrients) of the tidal front around Nantucket Shoals, however, the strength of the frontal activity may mitigate the intensity of these effects, primarily behind the tidal front (Christiansen et al. 2022). Under unstable conditions (i.e. variable wind speed from inconsistent direction(s)), these far field effects would be of reduced intensity and their extent (distance) would be reduced. At this time, we do not find that the available information supports a conclusion that the far-field wake effects due to the presence and operations of SouthCoast Wind project structures and WTGs, in addition to the other permitted offshore wind projects in the action area, are reasonably certain to impact the tidal front around Nantucket Shoals or the ecological function of fronts in aggregating zooplankton prey.

Considering the best available scientific literature as summarized above (Wang and Prinn 2010 and 2011), we do not find any evidence that the presence or operation of the SouthCoast WTGs or OSPs would lead to ocean warming that could affect ESA listed whales, sea turtles or fish or that there is the potential for the SouthCoast Wind project to contribute to or exacerbate warming ocean conditions. Note that effects of the discharge of heated effluent from the HDVC are addressed in Section 7.4.4.2; there we concluded that the discharge was not likely to adversely affect any ESA listed species. The available literature indicates that the operation of the WTGs may result in minor, localized cooling. If the effects predicted by the model in Wang and Prinn 2010 and 2011 and Golbazi et al. 2022 are realized as a result of the SouthCoast Wind project, minor cooling of waters in the action area in the summer months would be expected. We do not anticipate that any minor cooling of waters in the action area in the summer months would have any effects on the abundance or distribution of ESA listed species or the abundance or distribution of their prey. Based on the available information, any effects to listed species from any changes in water temperature (if there are any at all) will be so small that they cannot be meaningfully measured, evaluated, or detected and are therefore, insignificant.

Near-Field Hydrodynamic Effects from the SouthCoast Wind Project
Based on the best available information as summarized above, we expect that hydrodynamic wakes from the presence of the foundations as water flows around them will lead to disruptions in local conditions (i.e. increased turbulence). Although uncertainty remains as to the magnitude and intensity of effects that offshore wind facilities may have on altering oceanographic processes, studies consistently demonstrate increased turbulence (mixing and velocity) throughout the water column is expected to occur in the wake of foundations (Cazenave et al. 2016, Floeter et al. 2017, Miles et al. 2017, Schultz et al. 2020, Dorrell et al. 2022, Chen et al. 2024). Areas of increased turbulence beyond background levels may disrupt the density of prey aggregations suitable for foraging. Water moving around a foundation may also form eddies in the wake of each foundation which will have uncertain effects on concentrating or dispersing zooplankton prey. While there is limited available information about this effect, zooplankton can control their motility and can use movement to reduce their diffusion at higher turbulence levels, however, they are primarily transported by water movement (Genin et al. 2005, Visser 2007, Bi et al. 2014, Michalec et al. 2017), thus it is reasonable to expect that disruptions or changes in velocity and turbulence (i.e., around the foundation and in the resulting wakes) would affect the distribution and density of zooplankton in the affected areas. Increased mixing due to in-water wakes is hypothesized to increase the nutrient supply to the upper water column and in turn cause phytoplankton blooms, thus creating a food source for zooplankton, however, the linkage between blooms and increased zooplankton abundance is not linear thus this effect may occur periodically if primary production occurs and may not translate to all trophic levels (Daewel et al 2022). Increased mixing also has the potential to alter both the formation, occurrence, and breakdown of stratification. However, as addressed above, the southern New England region experiences strong stratification that would take large scale offshore wind development to alter broader regional patterns of stratification. As noted in the SouthCoast Wind COP Appendix F4, mixing caused by the presence of structures from the SouthCoast project is not expected to be able to create enough energy to impact regional stratification or change the seasonal timing of the setup and break down of stratification, however, hydrodynamic wakes will cause local changes to stratification (Chen et al. 2024). Stratification in the southern New England region typically begins in April, although with significant year-to-year variability (Lentz et al. 2003). As explained in Section 6 *Environmental Baseline*, this time period overlaps with the highest occurrence of right whales in southern New England and a regional peak in *Calanus finmarchicus* abundance (Leiter et al. 2017, Quintana-Rizzo et al. 2021, US DOC/NOAA/NMFS). Therefore, disruptions in stratification due to hydrodynamic wakes could

disrupt aggregations of *C. finmarchicus* and other copepods that may aggregate at the thermocline associated with stratification that sets up in April.

As explained in the *Environmental Baseline*, the southern New England region contains a diverse suite of copepod species that are distributed throughout the water column and occur seasonally. Some of these species are resident in southern New England and thus their presence in the area is not dependent on being advected into the region. However, other species are dependent on advection to be transported into the area (i.e., they are transported into the area via ocean currents). The best available information indicates that the dominant water flow bringing some zooplankton species to the region - particularly the copepod *C. finmarchicus*, a primary food source for right whales - flows south from the Gulf of Maine and from offshore areas to the east and wraps around Nantucket Shoals following bathymetric contours towards the SouthCoast WDA (Johnson et al. 2006, Ji et al. 2009, Bi et al. 2014). We do not expect the construction and operation of the SouthCoast Wind project to alter this broad current pattern because disruption of these current patterns would require larger climactic forcing events that are beyond the scope of what we consider reasonable to expect would result from the SouthCoast project; however, residence time of water within the WFA may increase due to the presence of WTGs and reduced wind stress in the lee of WTGs and potentially slow the transport of water (and thus prey) to the lease areas to the west of the SouthCoast WFA given predominant current direction (Carpenter et al. 2016, van Berkel et al. 2020). These potential changes will likely not significantly reduce the overall biomass of resident zooplankton in the SouthCoast WFA and surrounding waters where near-field effects may occur but may affect local distribution and, based on the available information, we find that it is not expected to cause a change that would be significant to ESA listed species. Based on the location of the SouthCoast WFA to west of the predominant currents flowing into southern New England, the supply of zooplankton from other regions into the WFA, such as *C. finmarchicus*, is also not expected to be altered; this conclusion is reached in consideration of the anticipated effects of the SouthCoast Wind project and other offshore wind projects that we have completed ESA consultation for to date. That is, even considering these projects as a whole, in consideration of the available information we do not find that current patterns are likely to be disrupted in a way that would affect the overall supply or biomass of zooplankton in the southern New England area or the SouthCoast WFA specifically.

As water moves around WTG and OSP foundations due to tides, currents, and other forces, the foundations can obstruct the flow and induce vertical and horizontal mixing in the water column (Dorrell et al. 2022). As described above, multiple modeling, lab, and in-situ studies have been conducted to examine the extent of in-water wakes caused by water flowing around foundations. These studies range in estimated distance of the wakes, however, peak turbulence is greatest closest to the foundation and dissipates with distance. Floeter et al. 2017 summarized modeling and remotely sensing studies documenting wakes with a length of approximately 1,000 m of each foundation. Miles et al. 2017 conducted a study in a tank setting and found that the velocity profile (speed) recovered to within 5% of the background level (i.e. no-pile level) in a distance downstream between 6 and 11 D (D = foundation diameter), with an average of 8 D, however, turbulence (mixing) does not get back to within 5% of the background level within the distance measured (15.5 D). By applying the Miles et al. 2017 findings to the parameters of the SouthCoast Wind project, the velocity profile would extend out to approximately 176 m from the 16-m diameter monopiles and turbulence would extend at least a distance of approximately 248 m from the monopiles. Shultze et al. 2020 conducted a study at a wind farm in the southern North Sea that had 6-m diameter monopiles in water depths ranging from 20-30 m and observed in-water wakes within an area of up to 70 m width that reached at least 300 m downstream of the monopile. In a review of potential physical and environmental effects of offshore wind development, Dorrell et al. 2022 referenced in-water wake lengths of 50 D. Based on the 16-m diameter monopiles proposed for SouthCoast, in-water wake effects would extend approximately 800 m. As noted in the SouthCoast Wind COP Appendix F4, this number was associated with Reynolds number dependence for relatively low Reynolds numbers (i.e. Re_D = 300-2,000 to $1x10^5$ for a typical North Sea example), whereas the SouthCoast Wind environmental conditions and WTG tower diameter give a Reynolds number of $3.36x10^6$, an order of magnitude larger. Based on this information we expect in-water wakes due to water flowing around SouthCoast Wind foundations to have a length of up to approximately 1,000 m and a width of at least 70 m (Floeter et al. 2017, Miles et al. 2017, Schultz et al. 2020, Dorrell et al. 2022). We note these distances may be shorter (and an area of weaker disturbance) for jacket foundations (the WTG and OSP jacket foundations would consist of multiple 4.5-m diameter pin piles to secure the foundation to the seafloor) as the diameter of piles are smaller and the jacket is a more open structure that allows water to flow through the structure. As described in Section 3 *Description of the Proposed Action* of this Opinion, SouthCoast has not selected a foundation type for either Project 1 or Project 2 and build out with all monopile foundations or a combination of monopile and jacket foundations are potential outcomes.

As copepod aggregations move throughout the WFA due to oceanographic conditions (e.g. currents, tides, frontal activity), due to the physical structures and an increase in both water velocity and mixing, it is reasonable to expect redistribution of prey. We expect that any effects to the distribution or density of copepod prey due to in-water wake effects extending from the foundations would be primarily limited to the area where changes in turbulence would be experienced. Increased turbulence in the lee of a turbine also has the potential to disrupt feeding behavior of copepods by redistributing their food and increasing their search radius and therefore foraging efficiency, which could theoretically affect the abundance and energy density of copepods available to foraging right whales (Visser et al. 2009). Any prey aggregation that is disturbed could potentially reform once water movement returned to background levels (the level an aggregation was assumed to occur at). We expect that these anticipated localized changes down-current of the foundations would result in localized changes in zooplankton distribution and abundance within discrete areas of the SouthCoast WFA extending approximately up to 1,000 m and a width of at least 70 m down-current from each foundation (n=149) (Floeter et al. 2017, Miles et al. 2017, Schultz et al. 2020, Dorrell et al. 2022). The areas of increased turbulence in the in-water wake of each foundation would occur whenever water is moving around a foundation. Given the rotary nature of currents and a high tide and a low tide on a semi-diurnal basis (approximately twice a day), it is expected that increased turbulence around the foundations would occur near constantly during the approximate 44 year period (i.e., the number of years during the construction, operations, and decommissioning period that covers the time from when foundations are installed to when they are removed) of the SouthCoast Wind project. We note that given the dynamic nature of the oceanic environment, the extent of the in-water wake may vary due to the tide cycle/height, storms, and other natural factors. Based on the spacing between the foundations (1.8 km x 1.8 km), the available information suggests limited opportunity for these areas of turbulence to interact and overlap which is expected to limit the impact of the distribution of plankton to discrete areas around each foundation within the SouthCoast WFA. The potential effects of disruptions to prey distribution and aggregations are specific to listed species that feed on plankton, whose movement is largely controlled by water flow, as opposed to other listed species that eat fish, cephalopods, crustaceans, and marine vegetation, which are either more stationary on the seafloor or are more able to move independent of typical ocean currents. These effects are primarily relevant to North Atlantic right whales and leatherback sea turtles as these are the only listed species that occur in the SouthCoast WFA that feed solely on planktonic prey (primarily copepods and gelatinous organisms respectively) whose aggregations are primarily driven by hydrodynamic processes. Prey aggregations may also be influenced by the physical presence of turbine foundations and subsequent reef effect; this is considered in Section 7.4.3.2. In the sections below, we consider the effects of these anticipated disruptions to prey on ESA listed species in the SouthCoast WFA.

Near-Field Effects to North Atlantic right whales

As established in other sections of this Opinion, bathymetric and oceanographic features concentrate aggregations of copepods, which provide a dense food source for North Atlantic right whales to efficiently feed upon. The increased turbuence extending from foundations (i.e., the hydrodynamic wakes) will likely disperse aggregations of copepods or otherwise affect the distribution of that prey given water flow (i.e. currents) is a primary transport mechanism (Bi et al. 2014, Michalec et al. 2017). We expect that this would decrease the efficiency of foraging for North Atlantic right whales. Given that increased turbulence will occur constantly throughout the year due to water flowing around foundations, any right whale in the SouthCoast WFA would be exposed to this effect; however, given that the highest abundance of whales and feeding activity is primarily expected to occur in the winter and spring (Leiter et al. 2017, Quintana-Rizzo et al. 2021, Roberts et al. 2024), we expect this effects of this disruption will primarily occur at this time year.

As noted above, North Atlantic right whales are the only ESA listed obligate zooplanktivores in the action area, feeding almost exclusively on copepods, which are primarily aggregated by bathymetric and oceanographic (e.g. temperature, salinity, density) features. Based on observations of right whales and abundance of *C. finmarchicus*, Record et al. (2019) hypothesized that a 40,000 m^2 threshold for *C. finmarchicus* represents the regional copepod density at which right whales are likely to occur, presumably exploiting high-density, small-scale patches of food. Mayo and Marx (1990) and Murison and Gaskin (1989) estimated the immediate decision-making threshold for right whale feeding to be approximately 1,000 m^3 *C. finmarchicus* for Cape Cod Bay and 820 m^3 *C. finmarchicus* for the Bay of Fundy. Kenney et al. (1986) estimated the minimum concentrations necessary for a net right whale energetic benefit contains *C. finmarchicus* densities in the 10^5–10^6 m^3 range. Given that right whales occur in southern New England, specifically around Nantucket Shoals, in highest densities during the winter and spring seasons when waters are often well mixed, bathymetric features and oceanographic conditions (e.g. tides, fronts, primary productivity, temperature, density) are thought to be acting to aggregate prey in patches efficient enough for right whales to forage (Leiter et al. 2017, White and Viet 2020, Quintana-Rizzo et al. 2021. The occurrence of foraging is also likely linked to the diversity of zooplankton species in southern New England, rather than the reliance on a single prey species (i.e. *C. finmarchicus).* As described above and detailed in the *Environmental Baseline*, the southern New England region contains a diverse suite of zooplankton species that are distributed throughout the water column and occur seasonally. Right whales have been observed in high abundances in southern New England during seasons when other copepod species (i.e. *Centropages typicus* and *Psuedocalanus spp.)* were in greatest abundance and *C. finmarchicus* abundance were low. Some of these species are resident in southern New England and thus their presence in the area is not dependent on being advected into the region. However, other species are dependent on advection to be transported into the area (i.e. *C. finmarchicus)* (US DOC/NOAA/NMFS). While we do not expect the presence and operation of the SouthCoast Wind WTGs and the foundations to significantly affect the abundance or biomass of copepods in the WFA area or broader region, we do expect the distribution of copepods in the SouthCoast WFA to be affected. We expect that these increased areas of turbulence flowing around each foundation will impact the distribution and density of copepods such that in these areas prey patches would be below the efficient feeding thresholds of right whales. Given that the areas impacted by turbulence from foundations would be limited to areas within an approximate length of up to 1,000 m and 70 m width of each of the 149 foundations (i.e., the anticipated dimensions of the hydrodynamic wake), and given the rotary nature of currents and a high tide and a low tide on a semi-diurnal basis (approximately twice a day), it is expected that increased turbulence around the foundations would be a near constantly occurring condition during the 44 year period of the SouthCoast Wind project covering the time from when foundations are installed to when they are removed, we expect the effects of turbulence on zooplankton prey, and therefore on foraging right whales in the SouthCoast WFA, to be biologically significant for at least some individuals (as addressed further below). We note that given the dynamic nature of the oceanic environment, the extent of the in-water wake may vary due to the tide cycle/height, storms, and other natural factors; however, the best available information supports the parameters we identify here. We do acknowledge the uncertainty around the range of potential hydrodynamic effects from offshore wind development, however, due to the proximity of the SouthCoast Wind project to Nantucket Shoals and the year round habitat use of the area by North Atlantic right whales, the 149 foundations in the WFA that are expected to cause increased turbulence throughout the water column, and the 44 year period when these effects can occur, considering the best available information we find that effects on the distribution of copepods in the area due to increased turbulence from 149 foundations is reasonably certain to occur.

Above, we establish that the presence of the SouthCoast foundations is expected to result in disruptions to the distribution and aggregation of copepods in an area extending up to approximately 1,000 m from each of the up to 149 project foundations. This is expected to affect the density of copepods in these areas. North Atlantic right whales are obligate zooplanktivores; it is well documented that efficient feeding requires high densities of prey (see for example, van der Hoop et al. 2019, Mayo and Marx 1990, Kenney et al. 1986, Kenney and Wishner 1995). As described by Pendleton et al. 2012, right whales feed on ultra-dense patches of copepods, often occurring at the scale of 1 to 10s of meters (citing Watkins & Schevill 1976, Wishner et al. 1988, Mayo & Marx 1990, Beardsley et al. 1996, Baumgartner et al. 2003a). The high drag from the right whale ram-filter foraging strategy places a limit on what prey densities will be energetically efficient to target (van der Hoop et al. 2019). As described by van der Hoop et al. (2019), to target high densities of small prey, right whales ram filter feed as they propel themselves forward with their mouths agape. Through cross-flow filtration, water moves parallel along the inner surface of the baleen plates, rather than perpendicular; this concentrates small (1–3 mm) copepods while slowing the overall flow of prey-laden water through the mouth, to then be swallowed (Werth and Potvin 2016). Surface and subsurface feeding occurs, with subsurface feeding more common (Baumgartner and Mate 2003). We expect that the wakes around each turbine will affect prey in a way that reduces the efficiency of foraging of right whales in the lease area and in surrounding waters (to the extent that the area outside the lease area is affected by the wakes from the outermost row of foundations). The reductions in the density of copepods in the wake of each foundation are likely to reduce the efficiency of foraging by right whales through reduced intake of prey per foraging attempt and/or by requiring additional energy expenditure for accumulation of prey resources. More frequent or deeper dives, changes in dive speed, or more overall time spent swimming with their mouths agape would increase the amount of energy that an individual spends on foraging. As explained below, we expect that for some individuals this will affect their overall energy budget and energetic reserves.

Here, we carry out the four-step assessment outlined in the NMFS Policy Directive regarding the ESA Term "Harass" ("Create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering"; PD 02-110-19, December 21, 2016) to determine if the effects to right whales expected to be exposed to the wakes around each foundation meet the definition of ESA take by harassment[48]. In our approach to the four-step analysis, we also took into account PD 02-110-19 guidance explaining that the term annoyance is used interchangeably with disturbance or other similar term referring to an act that disturbs an individual animal; "significantly disturb normal behavioral patterns" means a change in the animal's behavior (including feeding) that could reasonably be expected, alone or in concert with other factors, to create the risk of injury to an ESA listed animal when added to the condition of the exposed animal before the disruption occurred and the injury may be an impact that would reasonably be expected to negatively affect an animal's growth, health, reproductive success, and/or ability to survive (i.e. an effect that results from more than inconsequential behavioral response); and, that harassment does not require that an actual injury result or is proven, only that the behavioral response creates or increases the risk of injury.

Use of the lease area by North Atlantic right whales is well established and discussed extensively in the *Environmental Baseline* of this Opinion (see also Leiter et al. 2017, Quintana-Rizzo et al. 2021, O'Brien et al. 2022). The best available information supports a conclusion that the lease area supports the highest density and greatest numbers of individual right whales from December through May, particularly in the northeastern most portion closest to Nantucket Shoals, with presence and occasional foraging occurring outside of those months (Quintana-Rizzo et al. 2021, Leiter et al. 2017, Stone et al. 2017, Estabrook et al. 2022, O'Brien et al. 2022, Roberts et al.

[48] As noted in the PD, and explained in Section 7.1 of this Opinion, The four steps for an assessment of "harass" are: 1) Whether an animal is likely to be exposed to a stressor or disturbance (i.e., an annoyance); 2) The nature of that exposure in terms of magnitude, frequency, duration, etc. Included in this may be type and scale as well as considerations of the geographic area of exposure (e.g., is the annoyance within a biologically important location for the species, such as a foraging area, spawning/breeding area, or nursery area?); 3) The expected response of the exposed animal to a stressor or disturbance (e.g., startle, flight, alteration [including abandonment] of important behaviors); and; 4) Whether the nature and duration or intensity of that response is a significant disruption of those behavior patterns which include, but are not limited to, breeding, feeding, or sheltering, resting or migrating, as described above in this memorandum).

2024). The southern New England area, inclusive of the SouthCoast WFA, is a core winter and spring foraging area along with Cape Cod Bay; right whale habitat use is high in both areas during these seasons and individuals have been documented moving between both areas (Quintana-Rizzo et al. 2021). Between December through May, when there is sustained presence by individuals and regular feeding is most likely to occur, individuals persist in southern New England for an average of approximately 13 days (Quintana-Rizzo et al. 2021). As explained above, the in-water wake disturbance will occur in an area extending up to approximately 1,000 m from each of the up to 149 foundations. Year round, all right whales occurring in the lease area would be exposed to the in-water wake effects caused by the presence of one or more of the foundations, depending on how prey was distributed in the area at a given time and how an individual whale moved through the lease area. These exposures would be persistent, occurring throughout the duration of the individual's time in the lease year and any time the individual returned to the lease area, either in the same year or a subsequent year. As established in Section 7.1 *Effects of Underwater Noise*, we expect that operational noise would have insignificant effects on right whales; as such, we do not expect that operational noise would affect the distribution of right whales in the lease area. Thus, here we have established that all right whales in the lease area will be exposed to the expected habitat disturbance caused by the presence of foundations for WTGs and OSPs and associated disruption in prey aggregations resulting from the hydrodynamic wakes (i.e. an annoyance) (Step 1).

For an individual, exposure to this annoyance will be limited to the period when the individual is present within the lease area, and any area outside the lease area where wakes occur, but will be persistent throughout that period. That is, considering an individual that occurs in the lease area for the average period of 13 days during the winter months, that animal will be exposed to the foundation wakes over the duration of that period. We consider it unlikely that an animal would be within the lease area and not be exposed to this disturbance given the expectation that wakes will extend up to approximately 1,000 m from every foundation (n = 149) and the distribution of turbines in rows set 1,800 m (1.8 km) apart. Thus, it is unlikely that a right whale would occur in the lease area and not be exposed to the wakes. Right whales in this area would be resting, migrating, socializing, and/or foraging depending on the time of year. It is also possible that mating occurs in the lease area. The wake effects are not expected to impact any resting, migrating, socializing, or mating behaviors because there are no pathways from the hydrodynamic effects to impact those behaviors as the wake effects are not expected to affect the ability of any right whale to rest, migrate, socialize, or mate in the affected areas; therefore, effects on these behaviors are discountable. The normal behavioral pattern expected to be disrupted by the presence of WTG and OSP foundations and the resulting hydrodynamic wakes is feeding. As established above, foraging is expected to be affected through reduced efficiency. Also as established above, the affected area overlaps with a core winter foraging area; Quintana-Rizzo et al. (2021) found the annual percentage of right whales identified varied between 4 and 53% (13 ± 4%) of the minimum right whale population between 2011-2019 and during this study period, 87% of the current population had been sighted in southern New England and the discovery curve suggested an open population or that sightings in the area were underestimated. Additionally, a recent analysis of 2023 habitat use in southern New England showed 60% of the population in winter-spring alone (McKenna et al. 2023[49]). Based on these considerations, we consider the area affected to be biologically important to the species (Step 2).

Right whales feed to not only obtain sufficient caloric intake to support basic metabolic functions (which prevents starvation) but also to store energy (in the form of lipid storage in fat deposits). As described in van der Hoop et al. (2014), right whales, particularly reproductive females, routinely enter a phase of energy deficit during the fasting cycle associated with annual migrations between high-latitude foraging habitats and low-latitude calving areas; sufficient endurance to survive the fasting phase and subsequently recoup losses in the following foraging season are likely adaptations, though prolonged periods of an imbalance of greater magnitude may impact an individual's energy reserve to a point beyond which recovery is not possible (van der Hoop et al. 2014). Right whales rely heavily on stored energy for reproduction, particularly during lactation (Lockyer 1981, Miller al. 2011, Miller et al. 2012, Christiansen et al. 2018). It is well established that female body condition influences fecundity, fetal growth, and calf body condition (Lockyer 2007, Williams et al. 2013, Christansen et al. 2014, Christiansen et al. 2016). Poor body condition is thought to be having a significant influence on recruitment of female right whales into the breeding population (Christiansen et al. 2020, Reed et al. 2024), with prey availability considered to be a major driver of fecundity (Meyer-Gutbord et al. 2021). Stewart et al. (2022) show that smaller females produce fewer calves per reproductive year, with the authors concluding that this is possibly because the average interval between births is greater in shorter whales. Several authors have established that late gestation and lactation are costly energetic phases for female whales with female body condition declining prior to weaning (Miller et al. 2011, 2012, Villegas-Amtmann et al. 2015, van der Hoop et al. 2017, Christiansen et al. 2016, 2018) and noting that the length of the resting period between pregnancies may be governed by the degree to which the energetic reserves of females are depleted during lactation (Miller et al. 2011, Marón et al. 2015). Stewart et al. (2022) establishes that the total energetic reserves of smaller female whales would be inherently limited compared to larger females and notes that the poor body condition observed in the North Atlantic right whale population may be an indicator that females have insufficient energetic reserves to maintain a similar reproductive rate to southern right whales. Thus, feeding is important not only to prevent starvation but also to maintain or build up energetic reserves which support periods with decreased foraging opportunities and/or increased energy expenditure (e.g., long distance migrations), support future pregnancies and lactation, and to survive events such as illness, entanglements, and other injuries (e.g., sublethal ship strikes).

We recognize that there is some uncertainty in the degree to which an individual would be affected by reduced foraging efficiency and increased energy expenditure for foraging over the average 13-day duration an individual is expected to spend in the area. However, the available literature indicates that it is reasonable to expect that impacts to foraging may be consequential even over relatively short periods of time. Van der Hoop et al. (2019) establishes that right whales acquire their energy in a relatively short period of intensive foraging and concludes that even moderate changes in their feeding behavior or prey density are likely to negatively impact their yearly energy budgets and could reduce fitness substantially. Pettis et al. (2015) used visual health assessment to monitor body condition changes in individual right whales; the results of the

[49] Poster presented at NARWC October 2023. Available at: https://static-eu.webapp-portal.com/resources/freeqrd/lp/339775/2.pdf?1730423738; last accessed October 31, 2024.

study indicate that changes in right whale body condition can occur rapidly (and be detected visually), with both improvements and declines in condition detected over timeframes as short as 12 and 11 days, respectively.

The expected response of right whales exposed to the in-water wakes is an increase in energy spent on foraging behavior to obtain prey; that is, we expect that the impact of the disturbance would be a change in foraging behavior that resulted in the individual using more energy to obtain an amount of prey (and therefore, calories). As stated above, more frequent or deeper dives, changes in dive speed, or more overall time spent swimming with their mouths agape would increase the amount of energy that an individual spends on foraging. If this reduction in efficiency affected the overall intake of calories over the period the animal was feeding in the area, this would affect the animal's energy budget and energetic reserves (Step 3). We do not expect this would result in an abandonment of the lease area because we do not expect an overall reduction in prey availability at the regional scale (rather, we expect many localized changes in distribution and density).

It is possible that this disruption could result in right whales shifting foraging out of the lease area and into adjacent waters; however, this would result in similar effects due to increased energy spent on moving out of the lease area and potential decreased foraging efficiency in other areas due to more competition for resources (i.e., a greater number of individuals foraging in a smaller area). We also note it may not be reasonable to expect that shifts in foraging location would occur given that distribution of prey is expected to be patchy and therefore, prey may not be present/evenly distributed in different areas at the same time such that moving away from one area with prey that is affected by one or more in-water wakes would result in finding prey in a nearby area that is not disturbed by the wakes.

We have determined that the nature and duration or intensity of the expected response is a significant disruption of foraging behaviors for some, but not all, individuals that are exposed to the stressor (Step 4). While recognizing that overall the right whale population is in a stressed state and has low resilience, we expect that the consequences of the decrease in foraging efficiency and resulting increase in energy expenditure, as well as the potential for impacts to energy reserves, will not be the same for all individuals (i.e. as explained in PD 02-110-19, the condition of individual whales prior to exposure as well as the interaction of other stressors are relevant considerations in determining the severity of the disruption and its potential to increase the risk of injury). As noted by Fortune et al. (2013), the response of individual animals to changes in the quality and quantity of prey available to them will differ between young and old, pregnant and non-pregnant, and lactating and non-lactating whales. For animals that are generally healthy and in a good body condition, we expect that this increase in energy expenditure would have an insignificant effect on the animal's energy budget and reserves; that is, we expect that effects to the individual would not be able to be meaningfully measured, evaluated, or detected. However, for other individuals, we expect the behavioral disruptions will be significant. We consider it likely that the disruption to foraging behavior and resulting effect on energy budget and energetic reserves is likely to be significant for: individuals with an entanglement or other injury that affects their mobility or their ability to forage; individuals with sublethal injuries or entanglements that do not physically impair their ability to forage but are in poor health with a reduced body condition; and, reproductive females. We expect that individuals falling within these categories are particularly vulnerable to disruptions in their energy budget and energetic reserves because: their resiliency, or ability to withstand additional sustained stress, is low, or their ability to forage, or forage efficiently has already been compromised, or their energetic reserves are already depleted.

The sub-lethal effects of entanglement events include increased energetic demands and energy budget depletion (related to the additional drag and buoyancy of entangling gear) and reduced foraging ability, including direct reduction in feeding efficiency, which lead to significant increases in the energy expenditure of entangled right whales (Moore et al. 2006, Cassoff et al. 2011, Moore and van der Hoop 2012, van der Hoop et al. 2016, 2017, Reed et al. 2024). As noted in Sharp et al. (2019), in many chronically entangled whales, poor body condition and widespread epidermal cyamid ('whale louse') infestations were present, indicating overall compromised health. The authors note that in some of the cases reviewed, the entanglement configuration would have created a major feeding impediment through physical obstruction of the oropharynx, decreased efficiency of baleen plate filter feeding (all cases), or entanglement-induced trismus, restricting the ability of the mouth to open when lines to the rostrum were cinched at the flippers. Increased energy requirements may also be related to increased thermoregulation to compensate for loss of body fat or stress-related changes in metabolic rate (van der Hoop et al. 2014). Reed et al. (2024) notes that whether an individual has sufficient reserves is an important factor in whether a right whale can endure the energetic costs of entanglement. Pettis et al. (2015) notes that deleterious consequences of entanglement can lead to affected whales entering a state of reduced energy balance, which impacts their ability to recover from these events. Individuals with sub-lethal vessel strikes can have injuries that may affect their mobility (e.g., injuries to the fluke), ability to forage (e.g., injuries to the mouth or head) and/or may be suffering from infection or other health consequences (Pirotta et al. 2023, Sharp et al. 2019). Other individuals exhibit health conditions, such as emaciated body condition and swath skin lesions, that are indicators of poor survival (Moore et al. 2021, see also examples in the right whale UME data). We consider that the breadth of available literature indicates that entangled or otherwise injured individuals would require additional calories to support metabolic function and even greater calories to build or rebuild lipid stores/energy reserves.

Right whales are capital breeders, they rely on energy reserves stored prior to breeding to support reproduction (Pirotta et al. 2024, Hütt et al. 2023). Decreasing body size of females has effects on reproductive performance (Pirotta et al. 2024) and as health of reproductively active females declines, calving interval increases (Knowlton et al. 2022). When conditions are favorable, female right whales generally have a 3 year reproductive cycle consisting of 1 year of gestation, 1 year of lactation and 1 year of resting (to recover energy stores) (Best 1994). In order to support a subsequent pregnancy, resting females must have an improvement in body condition over time, reflecting the rebuilding of energetic reserves in the form of blubber. Following lactation, females are in a depleted condition, requiring the accumulation of resources over the resting period to support a future pregnancy and lactation period. Fortune et al. (2013) established that reproducing females have the highest energy needs of all demographic groups of right whales, related at least in part to the need for energy from their reserves to support pregnancy and lactation, and that lactating females may be experiencing an energy deficit. Recovering from this deficit during the resting period is necessary in order to support a future pregnancy.

Based on the available information, we expect that the decreased foraging efficiency experienced by injured and/or entangled whales and reproductive females would have adverse effects on these individuals; that is, these effects are neither beneficial, extremely unlikely to occur, or insignificant. For injured and/or entangled individuals and reproductive females, the decrease in foraging efficiency that they would experience while foraging in the lease area is a significant disruption of normal behavioral patterns (i.e., foraging), that creates the likelihood of injury. As explained in the NMFS PD and noted above,

> NMFS interprets the phrase "significantly disrupt normal behavioral patterns" to mean a change in the animal's behavior (breeding, feeding, sheltering, resting, migrating, etc.) that could reasonably be expected, alone or in concert with other factors, to create or increase the risk of injury to an BSA-listed [sic] animal when added to the condition of the exposed animal before the disruption occurred. An injury in the context of analyzing behavioral responses could be a physical injury or a physiological or other impact that would reasonably be expected to negatively affect the animal's growth, health, reproductive success, and/or ability to survive (i.e., an effect that results from a more than inconsequential behavioral response). Harassment does not require that an injury actually result or is proven; only that the behavioral response creates or increases the likelihood of injury.

In this case, the likelihood of injury is created by the change in feeding that, when added to the already compromised state of injured or entangled individuals and reproductive females, which as described above, are expected to have depleted energy budgets and energy reserves, either further depletes the animal's energy reserves or fails to maintain or increase those energy reserves. This in turn affects whether an injured or entangled individual has the energetic reserves to resist or recover from existing or new injuries or physiological impacts that could affect the individual's growth, health, and/or ability to survive. For reproductive females, this affects the ability of the female to recover or rebuild energy reserves to support future pregnancies and may make the individual more vulnerable and less able to recover from future injury or physiological stress that could affect the individual's health and reproductive success.

We have determined that the effects identified here (to the number of individuals quantified below) do not, however, meet the NMFS definition of "harm" in the ESA's definition of "take" (i.e., "an act which actually kills or injures fish or wildlife"). Such an act may include significant habitat modification or degradation where it actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding or sheltering" (50 CFR §222.102). As established above, we only find that there would be significant disruptions to feeding behaviors (and not resting, migrating, socializing, or mating). We do not expect that the individuals that experience this harassment would experience harm as we do not expect any actual injury to occur. That is, while the effects to foraging behavior and the resulting effects on an animal's energy budget will affect its resiliency (i.e., as established above, its ability to recover from and survive a physical injury or entanglement while supporting metabolic function and building or rebuilding lipid stores/energy reserves and for reproductive females, to support metabolic function while building sufficient energy reserves to maintain a calving interval, support a pregnancy, and nurse a calve), we do not expect foraging to be impaired to the extent that there will be an effect on the animal's overall energy budget or energy reserves in a way that would compromise its ability to successfully obtain enough food such that it would not be able to make seasonal migrations or participate successfully in breeding, calving, or nursing which we would consider to be "injury" in the context of the ESA definition of harm. That is, while the likelihood of the effects on foraging behavior resulting in a detectable change in body condition or to affect an individuals' fitness is created by the anticipated significant disruptions of normal foraging behavior, we do not expect any actual reductions in reproductive capacity or any mortality to occur (i.e., cause the animal not to be able to survive its existing injury or entanglement) as a result of the anticipated significant disruptions of normal foraging behavior. This is the case because: while the likelihood of injury is created by the anticipated significant disruptions of normal foraging behavior, we do not expect the effects on foraging behavior to have such severe effects on food intake that there would be an actual metabolic impact that would delay the calving interval, prevent recovery from an injury or entanglement or other physiological consequence (e.g., ability to mount a response to an infection) and because foraging behavior would only be affected in the lease area and thus the individual would not experience these behavioral disruptions when foraging in other areas (e.g., Cape Cod Bay, Bay of Fundy) at other times of year. We note that Pettis et al. (2017) found that the median timeframe between body condition changes measured visually in entangled North Atlantic right whales, across all entanglement groups was 259 days for declining conditions. This suggests that it would take more than foraging disruptions over a period of approximately 13 days (average residence time in southern New England), even if repeated over multiple years, to result in a detectable decline in body condition.

For reproductive females, while the likelihood of impacting body condition in a way that would delay the calving interval or affect the animal's ability to support a successful pregnancy or successfully nurse and wean a calf through impacts to energy budget and energetic reserves is created by the anticipated significant disruptions to normal behavioral patterns, we do not expect a disturbance that would actually cause a failed pregnancy or nursing event. This is the case because: we do not expect that consequences to reproductive females over the approximately 13-day period that an animal would experience this significant behavioral disruption would be great enough to result in a change in body condition that would affect future reproduction. We note that Pettis et al. (2017) found that the median timeframe between body condition changes measured visually in non-entangled reproductive female North Atlantic right whales, was 132 days for lactating females and 239 days for resting females (note a very small sample size of 2 resting females). This suggests that it would take more than foraging disruptions over a period of approximately 13 days, even if repeated over multiple years, to result in a detectable decline in body condition. Thus, while we expect the disturbance of foraging to be a significant disruption of normal behavioral (feeding) patterns, and create the likelihood of injury, we do not expect injury or mortality to actually occur: the effects to right whales from effects to foraging behavior associated with the hydrodynamic wakes and resulting impacts on the distribution and aggregation of copepod prey therefore do not meet the ESA definition of "harm."

We recognize that there is uncertainty at multiple points in this analysis related to the extent and duration of hydrodynamic wakes, the extent and duration of disruption to copepod prey and consequences on North Atlantic right whale foraging behavior, and the effects of the predicted foraging disruptions on individual right whales. We recognize that this analysis incorporates an assumption that right whales will continue to use the lease area in a substantially similar way that it has been used in recent years and that there is uncertainty related to future effects on climate and environmental conditions that may affect the extent to which zooplankton prey, and thereby right whales, use this area; however, at this time, the best available scientific information supports these as reasonable assumptions and provides no information to predict where or how right whale distribution may change. Accounting for the foregoing uncertainty, our analysis reasonably supports the conclusions reached with respect to the likelihood of behavioral disturbance and the likelihood of consequences of that disturbance: ESA take by harassment caused by the presence of WTG and OSP foundations and their wake disturbance is reasonably certain to occur. This analysis is based on our review of the best available scientific information as cited herein. The monitoring that will be required by this Opinion's ITS is designed and intended to gather additional information related to these predicted effects. We note that reinitiation of this consultation could be required if monitoring indicates that there are effects of the action that are not considered here.

To estimate the number of individual North Atlantic right whales that we anticipate will experience harassment due to the presence of WTG and OSP foundations, in the SouthCoast WFA, we first determined the number of right whales we expect to occur in the affected area (i.e., the lease area plus the area extending out 1,000 m), then we used the best available information on right whale demographics in southern New England[50] and the portion of the population that are categorized as injured (inclusive of entanglements) to estimate the number of reproductive females and previously injured individuals that we would expect to occur in the lease area. To carry out these steps, we first calculated the monthly mean North Atlantic right whale abundance in the southern New England region and in the SouthCoast lease area using the 2010-2019 data from Roberts et al. 2024. As established elsewhere in this Opinion, Roberts et al. (2024) is the best available data on right whale predicted density that is spatially explicit. The model predicts density in 25 km^2 grid cells in units of animals/100 km^2, so expected abundance for a cell equates to the density value divided by four. The lease area was buffered by 1,000 m to account for the area outside the lease area where the anticipated near-field in-water wakes would occur. To determine how many animals were expected in the buffered lease area relative to the southern New England region, we calculated the ratio between the estimated monthly abundance between the two areas. This results in an estimate of 2.3% of right whales occurring in the SouthCoast lease area relative to the southern New England region; that is, on average, we expect that approximately 2% of the right whales that are in southern New England are present in the buffered lease area. This percentage is from the month of April, which was the highest percentage but when compared to the rest of the months, does not make a meaningful difference in the calculations (i.e., 8 months had values $\geq$ 1.5%).

We then applied this ratio to the average demographic information of male, female, and reproductive female right whales in southern New England from 2018-2022 based on a query of the North Atlantic Right Whale Consortium database and average serious injuries, sublethal, and

[50] Defined as the body of water south of Martha's Vineyard and Nantucket extending to the Nantucket to Ambrose Traffic Separation Scheme and bounded to the west by the study area of the New England Aquarium aerial survey and to the east by the North-South lanes of the Traffic Separation Scheme servicing Boston.

illness cases from the ongoing North Atlantic right whale UME[51] from 2017-2024 (present), irrespective of sex. The average demographic information over the latest 5-year period of available data best reflects current usage of the southern New England region by different right whale demographic classes relative to the current status of the population. Demographic information at the scale of the lease is not available; however, given that we do not have evidence indicating that use of the lease area by any demographic group, including reproductive females, would be any different than the southern New England region, it is reasonable to expect a similar demographic split of right whales in the lease area as is seen in southern New England. Following these steps, we calculate that there are an estimated 21 reproductive females in the southern New England region annually. Applying the approximate 2% right whale relative abundance value to the demographic information, this results in 0.5 reproductive females occurring in the SouthCoast lease area annually.

To identify the portion of individuals in the lease area that we expect would have an injury or impairment, we used the North Atlantic right whale UME data, specifically the serious injury and morbidity (sublethal injury and illness) cases; this information provides the most up-to-date information on the health-compromised status of right whales. While the location that an animal was first observed with an injury is recorded and data on subsequent sightings for some individuals is available; information is not available that would allow us to identify any differences in the distribution of injured individuals throughout the species range. Additionally, injured animals are susceptible to suffer an injury throughout their range and given the geographic location of southern New England midway throughout their range and the high usage of this habitat by the population, we expect injured whales will occur in this habitat. Injury assessment of right whales is often retrospective as observers may not notice an injury immediately, thus an injured animal may not be noted as such until photographs are reviewed. As such, and absent any information that would support a different conclusion, we expect that the proportion of right whales in the lease area with injuries would be similar to that range-wide. Considering that there are approximately 14 serious injury and morbidity (sublethal injury and illness) cases annually and applying the approximate 2% right whale relative abundance value to the UME information, this results in 0.3 previously injured North Atlantic right whales occurring in the SouthCoast lease area annually.

Taken together, this results in an estimate of 0.8 North Atlantic right whales annually that will experience effects due to disruption of foraging behaviors that we have determined meet the NMFS interim definition of harassment. We expect that these effects will occur over a 44-year period (i.e., the number of years during the construction, operations, and decommissioning period that covers the time from when foundations are installed to when they are removed). We considered whether this estimate should be rounded up to whole individuals on an annual or total duration basis and also considered whether the predictions by group (i.e., 0.5 reproductive females/year, 0.3 previously injured animals/year) should be rounded up individually. Implementing these various approaches would result in predictions ranging from 35.2 to 88 individuals. Considering the duration of the project, the inputs to our calculations, and that it is not possible for a fraction of an animal to be harassed, we find that an average of 1 individual per year (reproductive female or previously injured individual) is reasonably certain to occur.

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[51]https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2024-north-atlantic-right-whale-unusual-mortality-event; last accessed October 30, 2024.

Although the entire population is susceptible to a range of stressors, together this information provides the best estimate of North Atlantic right whales that will experience harassment/fitness consequences due to foraging disturbances due to the presence of project structures. We recognize that the absolute number of individuals that experience harassment in a given year may be variable and dependent on the number of individuals in the population, the number of reproductive females, and the number of individuals with injuries; however, we find that the number established here reasonably accounts for that variability to the extent that it is predictable. Further, we note that information that is released regularly regarding the size of the right whale population, density estimates, the estimated number of reproductive females, and documented injuries and entanglement, will allow us to evaluate whether our predictions of the number of right whales expected to be harassed remain accurate. We expect this number of individuals to experience harassment beginning in the first year following installation of project foundations. As explained in this Opinion's ITS, the reinitiation trigger, and the associated required monitoring, will allow for tracking the anticipated take over time.

Near-Field Effects to Other ESA Listed Whales
Fin and sei whales feed on both small schooling fish and zooplankton, including copepods. As explained above, we expect the SouthCoast Wind project to have localized effects on the distribution and aggregation of zooplankton prey species as described above; however, we do not expect any overall reduction in the amount of prey in the action area.

Fin whales do not feed exclusively on zooplankton, they also feed on small fish. Like right whales, the efficiency of foraging on zooplankton by fin whales in the lease area may be affected. However, as fin whales forage on other resources which will not be affected by the hydrodynamic wakes (i.e., small schooling fish) we do not expect that the consequences to fin whales would be the same as for right whales. Given this, we expect that any decrease in foraging efficiency for any fin whales foraging in the lease area would have effects that would be so small that they could not be meaningfully measured, evaluated, or detected; as such, effects would be insignificant.

Sei whales occur primarily in deeper offshore waters and are expected to be rare in the WFA, therefore there is a very low likelihood that any sei whales will be foraging in the area affected by the SouthCoast Wind project. Like right whales, the efficiency of foraging on zooplankton by sei whales in the lease area, although rare, may be affected. However, as sei whales forage on other resources which will not be affected by the hydrodynamic wakes (i.e., small schooling fish) we do not expect that the consequences to sei whales would be the same as for right whales. As such, effects to foraging sei whales are extremely unlikely to occur and discountable. Blue whales feed almost exclusively on krill; however, blue whales occur primarily in deep offshore waters and are expected to be rare in the WFA, therefore there is a very low likelihood that any blue whales will be foraging in the area affected by the SouthCoast Wind project. As such, effects to foraging blue whales are extremely unlikely to occur and discountable. We do not expect any impacts to the abundance or distribution of the cephalopods on which sperm whales forage as these prey typically occur further offshore and are free swimming. As no effects to sperm whale prey are anticipated, we do not expect any effects to sperm whales.

Near-Field Effects to ESA Listed Sea Turtles

Leatherback sea turtles, which feed on zooplankton (i.e. jellyfish and other gelatinous organisms), occur in the summer and fall primarily on and adjacent to Nantucket Shoals, however, they occur throughout southern New England. Far-field atmospheric wake effects from the presence and operation of SouthCoast WTGs will likely reach Nantucket Shoals, which has the potential to alter the distribution of zooplankton. As noted above, these effects may be mitigated by the shallow tidal nature of the Shoals area. At this time, we do not find that the available information supports a conclusion that the far-field wake effects are reasonably certain to impact the tidal front around Nantucket Shoals or the ecological function of fronts in aggregating zooplankton prey in a way that would be significant to ESA listed species. Zooplankton that are fed on by leatherback sea turtles are able to move more readily than copepods; thus, the distribution of these prey species is less likely to be affected by the hydrodynamic wakes. We also note that leatherbacks do not rely on as dense aggregations of prey that potentially could be dispersed by in-water wakes. As such, we expect the areas of increased turbulence around each foundation and any resulting effects to the distribution of leatherback sea turtle prey would be so small that they could not be meaningfully measured, detected, or evaluated and therefore would be insignificant. We do not anticipate any higher trophic level impacts from anticipated changes in the distribution and aggregation of zooplankton; that is, we do not anticipate any associated effects to pelagic fish or benthic invertebrates that depend on plankton as forage. Effects to the benthic prey base of green, Kemp's ridley, and loggerhead sea turtles are extremely unlikely to occur as a result of the near-field hydrodynamic effects of the presence and operations of the SouthCoast Wind project considered here.

Near-Field Effects to ESA Listed Fish

During times when Atlantic sturgeon occur in the marine environment, they primarily feed on benthic invertebrates and small fish such as sand lance, which are either free swimming or live on the seafloor. Effects to the distribution or availability of their prey, and any effects to Atlantic sturgeon are extremely unlikely to occur as a result of the near-field hydrodynamic effects of the presence and operations of the SouthCoast Wind project considered here. Therefore effects to Atlantic sturgeon are discountable.

Summary of Effects to Oceanic and Atmospheric Conditions due to Presence of Structures and Operation of WTGs

In summary, based on the best available scientific information pertaining to the effects of offshore wind facilities on oceanographic and atmospheric conditions, and in recognition of the existing uncertainty related to the impacts as acknowledged herein, we expect the presence and operation of the proposed SouthCoast Wind project to have localized effects to the distribution and aggregation of the planktonic prey of listed species, however, we do not expect any overall reduction in the amount of prey in the WFA or action area. Near-field in-water turbulence around each foundation is expected to result in changes in the distribution of copepod prey that will affect North Atlantic right whale foraging which, as explained above, will result in effects that meet NMFS' interim definition of harassment. Anticipated changes in water movement may have effects (positive or negative) on local zooplankton distribution and abundance due to potential changes in primary production patterns. Given the predominant wind direction is from the west/northwest/southwest, depending on time of year, under stable atmospheric conditions, we would expect any farther field effects to most commonly occur to the northeast of the

SouthCoast Wind lease area on Nantucket Shoals and in the OCS-A 0522 lease area, east adjacent to the SouthCoast WFA, depending on the predominant wind direction.

We note that as the scale of offshore wind development in southern New England and the greater Mid-Atlantic Bight region increases and the number of WTGs and foundations increases, the scope and scale of potential far and near-field effects may also increase and influence the environmental baselines for future projects. We also note that development outside of this area (i.e., the Gulf of Maine) could affect regional patterns of zooplankton distribution, including copepods transported into other regions. Our Biological Opinions prepared for the South Fork, Revolution Wind, Sunrise Wind, New England Wind, and Vineyard Wind 1, (i.e., the commercial scale wind projects in the MA and RI/MA WEAs, which is the portion of the action area relevant here) assessed the construction, operation, and decommissioning of each project and concluded that there may be localized changes in environmental conditions in the respective lease areas and surrounding waters within a few hundred meters to tens of kilometers down-current/downwind of the foundations and WTGs, with effects on zooplankton prey limited to the area within a few hundred meters of each foundation. Considering the anticipated effects of the SouthCoast Wind project in light of the effects anticipated to result from the South Fork, Revolution Wind, Sunrise Wind, New England Wind, and Vineyard Wind 1 projects, does not change our conclusions described above. Under conditions when wind is blowing consistently from the west/northwest (predominant wind direction in the winter, spring, and fall), SouthCoast Wind may fall in the wind wake of these projects, this could reduce wind-driven water column mixing due to reduced wind stress in the SouthCoast WFA but extend wind deficits in the lee of the SouthCoast Wind project from their original speed, however water column mixing could be offset by increased turbulence from the SouthCoast Wind foundations due to the flow of water in the region. The Empire Wind project is approximately 233 km to the southwest of the SouthCoast Wind project, the Atlantic Shores-South project is approximately 320 km to the southwest of the SouthCoast Wind project, the Ocean Wind 1 project is approximately 341 km to the southwest of the SouthCoast Wind project, the Maryland Wind project is approximately 431 km to the southwest of the SouthCoast Wind project, and the CVOW-C project is approximately 570 km to the southwest of the SouthCoast Wind project. Once built, we expect that these projects will be too far away for oceanographic, hydrodynamic, or atmospheric effects to impact the SouthCoast WFA. Therefore, while in the future there may be additive effects resulting from the buildout of multiple adjacent or nearby lease areas, the conclusions reached in this analysis do not change when considering the effects in the context of the *Environmental Baseline*.

7.4.4 Operation of the HVDC

The analysis presented here is based on the information presented in BOEM's BA and the draft permit and associated information published by EPA Region 1 in October 2024[52], which is more recent than the description presented in BOEM's BA. Note that this effects analysis considers the HVDC will operate consistent with the conditions described in the draft permit. We note that if the final EPA permit includes conditions that would result in effects of the action that were not addressed here (e.g., changes to the cooling water intake structure that would change the consideration of impingement/entrainment), reinitiation of consultation may be necessary (50 CFR 402.16). We also note that EPA's permit addresses intake and discharge for a five-year

[52] https://www.epa.gov/system/files/documents/2024-10/draftma0006018permit-2024.pdf; last accessed October 21, 2024.

period and that a new permit application will be required for any subsequent five-year period. Each issuance of a NPDES permit for the HVDC is a federal action that requires ESA Section 7 consultation. As such, at each 5-year period when EPA proposes a new or renewed permit, there will be an opportunity to consider the best information available at that time and determine the effects of continued operation of the HVDC on ESA listed species. We also note that the draft permit contains extensive monitoring requirements that are designed in part to validate the assumptions about impingement and entrainment that were considered in developing the draft permit. Reinitiation of this consultation would be necessary if monitoring provides information indicating that there are effects of the operation of the facility that were not analyzed here. We also note that should any additional HVDC be proposed (i.e., for Project 2), ESA Section 7 consultation would be required to evaluate the effects of the action on ESA listed species.

SouthCoast Wind has applied to the U.S. EPA for issuance of a National Pollutant Discharge Elimination System (NPDES) permit (permit No. MA0006018) to authorize pollutant discharges and cooling water withdrawals at a single HVDC for SouthCoast Project 1. EPA is proposing to issue a permit with a number of standard and special conditions. The NPDES permit would authorize the following: (1) the intake and discharge of non-contact cooling water, (2) the discharge from HVAC and freshwater cooling system pumps/drains; (3) the discharge of treated stormwater exposed to industrial activities at the OCS-DC1 for Project 1.

The proposed OCS-DC1 for Project 1 will be centrally located in the northern part of the lease area. Inter-array cables placed under the seafloor will be used to transfer electrical energy from the wind turbine generators to the offshore converter station platform. The OCS-DC1 will withdraw seawater for non-contact cooling of heat produced in the conversion of electricity from AC to DC. Converting power from AC to DC generates heat and requires cooling. To cool the power components, the proposed OCS-DC1 includes a heat exchanger. SouthCoast Wind is proposing to withdraw ocean water through a subsurface intake to use as its cooling medium. The waste heat will then be discharged as thermal effluent to the Atlantic Ocean. The effluent will also contain sodium hypochlorite (i.e., bleach), which will be used to prevent biological growth in the cooling system. Both the heat and the sodium hypochlorite are pollutants under the CWA § 502 (6). The OCS-DC1 outfall 001 is proposed to be located at latitude 40° 48’ 18.16” (40.805045 N), Longitude -70° 19’ 29.41” (-70.324838 W) in the Atlantic Ocean.

7.4.4.1 Water Withdrawal

As described in the draft NPDES permit, during operations, the OCS-DC1 for Project 1 would require continuous cooling water withdrawals and subsequent discharge of heated effluent back to the ocean. The non-contact cooling water system for the proposed OCS-DC1 will include three separate vertical intake pipes (caissons), each with its own: (1) intake screen (located at the bell mouth opening of the intake) with openings not to exceed 5” by 5”, (2) inline pump strainer (located within the intake pipe prior to the pump) with outer screen size of 0.375” (9.5 mm), (3) submerged seawater lift pump, (4) pump flow-line filter (with a typical mesh size of 250 um); (5) plate heat exchanger (also called a plate-and-frame heat exchanger). The system is designed to operate with one or two pumps running simultaneously, while the third pump provides redundancy and will be kept on stand-by. The non-contact cooling water intake structure is expected to withdraw cooling water from the ocean in the immediate vicinity at a maximum daily rate of up to 9.9 million gallons per day (MGD) and maintain an intake velocity of 0.5 feet per second (0.15 meters per second) or less; as clarified in the draft permit, this means that there will be through screen velocity of 0.5 fps at each point of entry (i.e., each screen or other exclusionary device). As noted in the draft NPDES permit, each of the three pumps will withdraw a maximum of 4.95 MGD of seawater for cooling but only 2 pumps may be running simultaneously. Our considerations of the risk of entrainment and impingement in the cooling water intake structures for listed species and their prey is presented below.

Entrainment of Listed Species at the OCS-DC1
Entrainment occurs when small aquatic life forms are carried into and through the cooling system during water withdrawals. We note that the requirement in the draft permit to limit the openings at the trash racks to no more than 5” by 5” would prevent even the smallest ESA listed species that occurs in the area from entering the intake system. To be entrained at the OCS-DC1 facility, an organism must be able to pass through the intake and then through the smaller screenings. All whales, sea turtles, and Atlantic sturgeon are considerably larger than the size of the intake screens, making entrainment impossible. Because of this, no entrainment of listed species will occur.

Impingement of Listed Species at the OCS-DC1
Impingement occurs when organisms are trapped against cooling water intake screens or racks by the force of moving water. Impingement happens when aquatic species cannot escape from the screen or rack and become stuck. Here, we consider the potential for a whale, sea turtle, or Atlantic sturgeon to become impinged on the cooling water intake. As described in the draft NPDES permit, in the immediate area of a cooling water intake, the velocity of water entering the intake exerts a direct physical force against which aquatic organisms must act to avoid being trapped or drawn into the cooling system. Reducing the rate of flow of cooling water (or the intake velocity) reduces impingement because a low enough intake velocity will allow motile organisms to swim away and avoid becoming trapped against the intake screens. Maintaining a through-screen design intake velocity limit of 0.5 fps or less, as required by conditions of the draft permit, is well-supported by existing literature as an appropriately protective measure to minimize impingement at cooling water intake structures (see 24 See 40 CFR § 125.84(c)(1). 40 CFR § 125.94(c)(2) and (3), and 40 CFR § 125.134(b)(2) as referenced in EPA’s draft permit). This through-screen velocity threshold of 0.5 fps, is set at a level that is expected to allow juvenile and adult fish to swim away and avoid becoming impinged on the trash racks or entrapped within the intake pipes. Here, we consider the risk for impingement of ESA listed species that occur in the area around the OCS-DC1 (i.e., within the SouthCoast Wind WFA) to become impinged at the intake.

Whales in the action area are expected to be at least 13 feet long (the minimum size of newborn calves, which is the smallest size of these whale species anywhere; NMFS OPR 2012), with body widths of several feet. Whales are capable of swimming speeds of several miles per hour; the low intake velocity (0.5 fps) and the requirement for intake openings to be screened with openings no greater than 5-inches by 5-inches makes it extremely unlikely that any whales would be impinged at the intakes. We are not aware of any incidences of whales becoming impinged on cooling water intakes anywhere in the U.S.

The impingement of sea turtles has been documented at some cooling water intake structures at nuclear power plants on the U.S. East Coast (e.g., Oyster Creek, NJ; St. Lucie, FL). Factors related to the potential for impingement likely include intake velocity (animals may have more difficulty escaping areas with higher intake velocity), plant location, and the physical features of the intake structure. Sea turtles typically cruise at speeds of 0.9-1.4 miles per hour (3.3-4.4 fps) and juvenile sea turtles forage in areas with currents of up to 2 knots (3.4 fps). The required flow through-screen velocity (0.5 fps or less) and the requirement for intake openings to be screened with openings no greater than 5-inches by 5-inches makes impingement of sea turtles extremely unlikely to occur.

Juvenile and adult shortnose sturgeon (body lengths greater than 58.1cm) have been demonstrated to avoid impingement and entrainment at intakes with velocities as high as 3.0 feet per second (Kynard et al. 2005). Considering that Atlantic sturgeon would have swimming capabilities at least equal to shortnose sturgeon, any Atlantic sturgeon in the WDA would be able to avoid becoming impinged on the crash bars and intake screens. This is a reasonable assumption given that the Atlantic sturgeon that would be present in the action area are expected to be larger than the shortnose sturgeon tested by Kynard and because these species have similar body forms, we expect swimming ability to be comparable between individuals of similar sizes. As such, any impingement of Atlantic sturgeon is extremely unlikely to occur.

Impingement and Entrainment – Effects on Prey
Here we consider the effects of the loss of potential prey species due to impingement or entrainment at the OCS-DC1 station for the SouthCoast Wind Farm Project for ESA-listed whales, sea turtles, and Atlantic sturgeon that may be foraging in the action area. As noted above, the intake velocity and screen size are consistent with the 0.5 fps or less intake velocity recommended design to minimize risk of impingement and entrainment and are considered to be protective against impingement and entrainment of juvenile and adult life stages of fish. Therefore, it is anticipated that only egg and larval stages of fish are at risk of entrainment. Other ichthyoplankton species that are smaller than 5mm may also be vulnerable to impingement and/or entrainment. These small individuals would be able to pass through the initial rack structure (5" by 5" openings) and then could be vulnerable to impingement on the lift pump strainer screens (if they were too big to pass through the 9.5 mm mesh) or if small enough, could pass through the strainer screen mesh and become impinged on the pump flowline filters (250 micrometer mesh). Given the location of the intake and the low intake velocity, no impingement or entrainment of benthic resources or sea grasses would occur.

As part of the application for the NPDES permit, SouthCoast Wind estimated larval entrainment using data from NOAA's MARMAP and EcoMon datasets. EPA reassessed the same MARMAP and EcoMon data from SouthCoast Wind's analysis to estimate densities for all species collected in those surveys and to address what EPA determined to be potential for underestimates of entrainment. Assuming a daily intake flow of 9.9 MGD, SouthCoast Wind estimates a range of 8.3 million to 174.4 million larvae will be entrained each year, with a mean estimate of 83.2 million larvae (NPDES Permit No. MA0006018). EPA notes that eggs typically occur at higher densities than larvae and annual entrainment could be expected to increase by a factor of two or more but the relative proportion of eggs in the overall entrainment totals at the OCS-DC1, however, is less certain, in part because the eggs of most offshore species are buoyant

(Sundby and Kristiansen 2015, as cited in the draft NPDES permit), and it is possible that the location of the intake (at a depth of more than 100 ft.) may minimize entrainment of eggs as well as larvae.

As noted in the draft NPDES permit, SouthCoast Wind did not evaluate entrainment of *Calanus finmarchicus*, which is a species of copepod that is important to the foraging base of endangered NARWs. However, to reduce potential impacts on species of zooplankton, the OCS-DC1 station (often referred to in the SouthCoast Wind BA as the northernmost HVDC converter OSP) will be located outside of a 6-mile (10-kilometer) buffer of the 30-meter isobaths from Nantucket Shoals. In addition, BOEM is proposing a mitigation measure (NS-1 in Table 3.3.2 in the SouthCoast Wind BA, 2024). The measure notes that no open-loop cooling systems will be permitted within the enhanced mitigation area of the SouthCoast Wind Lease Area (Table 3.3-2 in SouthCoast Wind BA, 2024).

Given that no entrainment evaluation of *Calanus finmarchicus* was carried out, we are considering other available information. Sunrise Wind evaluated the potential for entrainment of copepods *Calanus finmarchicus* during the operations phase of a proposed converter station with similar design to the SouthCoast OCS-DC1. The methodology and approach that the Sunrise Wind Farm Project used to evaluate entrainment of copepods can be found in the Sunrise COP Appendix N2 (Sunrise Wind 2022i) and is also summarized in the EPA's draft NPDES permit (permit No. MA0004940). The Sunrise Wind Farm Project estimated entrainment of over 1.1 billion *Calanus finmarchicus* annually, which according to the Sunrise Wind Farm NPDES Application and the BA, represents about 0.1% of the anticipated annual abundance of this species in the Sunrise Wind Farm lease area (assuming an even distribution of organisms and average depth of 45 m). The EPA and BOEM reviewed the Sunrise Wind Farm OCS-DC entrainment analysis for copepods and determined it was a reasonable analysis based on the best available information. Given that the Sunrise OCS-DC is similar in design to the OSC-DC1 for the SouthCoast Wind Farm Project and will be located in a similar location, it is reasonable to expect that the risk of entrainment of copepods at the SouthCoast OCS-DC1 would be similar.

We are not aware of any similar operating cooling water intake structures in the vicinity of the SouthCoast lease area. However, long term data sets are available for the Pilgrim Nuclear Station (withdrawing 510 million gallons cooling water/day, which operated with a cooling water intake in Cape Cod Bay (a high use area for foraging right whales in the spring) and the Seabrook Nuclear Station, which is located with an intake in the Gulf of Maine (withdrawing 600 million gallons of cooling water/day. The Pilgrim intake structure consisted of a rack system to screen out large debris (vertical bars spaced 3" apart) and a 0.25" x 0.5" mesh traveling screen system (intake velocity of 1 fps and through-screen velocity of 2 fps). The Seabrook intake entrance is 6,000 feet offshore; the intake tunnels are equipped with vertical bars spaced 5" apart. There is also a *3/8"* mesh traveling screen system with intake velocities of approximately 1 fps).

The zooplankton community in Cape Cod Bay has been monitored by the Massachusetts Water Resources Authority (MWRA) since 1992, both near the MWRA outfall and at farfield stations, including stations in Cape Cod Bay. As addressed in our ESA consultation on the relicensing of the Pilgrim facility, there have been no changes in the zooplankton community at any of the stations beyond normal ecological fluctuations (Werme *et at.* 2011). Similarly, the abundance of the three primary copepod that light whales feed on is variable in Cape Cod Bay, both monthly and annually (Stamieszkin *et at..* 2010); a review of data on copepods collected in Cape Cod Bay from 2003-2010 compiled by Starnieskin *et al* (2010) reveals no trends of enrichment or decline for any of the three taxa studied *(Catanus, Pseudocalanus* and *Centropages).*

Extensive pre-and post-operation monitoring has occurred at the Seabrook Nuclear Power Station in New Hampshire. Seabrook withdraws approximately 600 million gallons of water per day (MOD; NRC 2011) (Pilgrim withdraws a maximum of510 MOD). As reported in the DEIS prepared by NRC for relicensing of Seabrook, NextEra compared the density of holoplankton, meroplankton, and hyperbenthos taxa prior to and during operation at nearfield and farfield sites (3-8 miles away from the intakes and discharge and considered to be outside the influence of the facility). No significant difference in the density of holoplankton (copepods are considered holoplankton) or meroplankton taxa prior to and during operations or between the nearfield and farfield sampling sites were reported. These results suggest that Seabrook operations have not noticeably altered· holoplankton or meroplankton density near Seabrook in the more than 20 years that Seabrook has been operating.

The maximum daily intake at the SouthCoast cooling water intake structure (9.9 MGD) is less than 20% of the water withdrawn at the Pilgrim or Seabrook facilities. Given the much greater intake volumes, combined with the higher intake velocity, the amount or extent of entrainment of copepods is expected to be much higher at either of these facilities than at SouthCoast. As noted above, extensive monitoring has not revealed any change in the abundance or distribution of copepods that would suggest that the losses occurring at either facility is having a detectable effect on copepods in Cape Cod Bay or the Gulf of Maine.
While some copepods are likely to be lost to entrainment at the SouthCoast OCS-DC station each year and the number of individuals is likely to be high, the reduction is expected to be undetectable from natural variability. As such, we expect any effects to foraging right whales to be so small that they cannot be meaningfully measured, detected, or evaluated, and therefore, are insignificant.

As described in the BA, the anticipated loss of copepods is representative of impacts to other zooplankton and fish eggs and larvae. As such, it is expected that the mortality of early life stages of benthic and pelagic prey species will be no more than 0.1% of the abundance in the lease area and be indistinguishable from natural variability. The monitoring required by the EPA permit will resolve any uncertainty about these estimates and impacts. Given the available information, effects to listed species from the entrainment of ichthyoplankton at the OCS-DC1 will be so small that they cannot be meaningfully measured, evaluated, or detected and are therefore, insignificant. We note that should information obtained from EPA's required monitoring indicate that there are effects to listed species that are different than what was considered here, reinitiation of consultation may be required.

7.4.4.2 Effects of Discharge of Effluent from the OCS-DC

Total Residual Oxidants
As described in EPA's draft permit, chlorine and chlorine compounds are toxic to aquatic life. Free chlorine is directly toxic to aquatic organisms and can react with naturally occurring organic compounds in receiving waters to form toxic compounds such as trihalomethanes. As described

in the draft permit, SouthCoast intends to prevent biofouling of the OCS-DC cooling assembly by using an electrochlorination system that will use electrolysis of seawater to produce sodium hypochlorite. The chlorinated seawater will be continuously injected via a valve within the intake pipes (upstream of the saltwater lift pumps) when the pumps are operating. The chlorinated seawater will mix with raw seawater and be directed through the cooling water system, including the heat exchangers, and discharged through the outfall. The electrochlorination system will be operated continuously with a design flow of 14.6 gpm per intake being utilized and a proposed actual flow of 6.81 MGD and 95 kg during a maximum discharge flow of 9.9 MGD (Per draft NPDES Permit No. MA0006018). The dosage of chlorine will be automatically adjusted based on feedback provided by an analyzer located downstream of the heat exchangers to maintain a concentration near zero at the outfall. EPA's National Recommended Water Quality Criteria for aquatic life in saltwater for total residual chlorine (TRC) are 7.5 micrograms per liter (µg/L) (0.0075 mg/L) (chronic) and 13 µg/L (0.013 mg/L) (acute). In this case, because the source water contains bromides (e.g., saltwater), chlorine is expressed as total residual oxidants (TRO) instead of TRC. See 40 CFR § 423.11(a). Considering that the electrochlorination system will be operated continuously and the dosage system can be automatically adjusted based on the concentration downstream of the heat exchangers, the Draft Permit proposes water quality-based TRO limits of 7.5 µg/L (0.0075 mg/L) as an average monthly value and 13 µg/L (0.013 mg/L) as a daily maximum value at the outfall. As described by EPA, compliance with these TRO limits is expected to be protective of aquatic life and is consistent with the proposed operation of the system to achieve chlorine concentrations near zero. EPA has set a compliance level of 30 µg/L for TRO in the Draft Permit, which is equivalent to the minimum level for the analytical method that has the lowest method detection limit of the methods approved under 40 CFR Part 136.

Data on toxicity of chlorine and chlorine compounds as it relates to whales, sea turtles and sturgeon is extremely limited. In the absence of species specific chronic and acute toxicity data, the EPA aquatic life criteria represent the best available scientific information. Absent species specific data, it is reasonable to consider that EPA's aquatic life criteria are applicable to NMFS listed species as these criteria are derived from data using the most sensitive species and life stages for which information is available. A suite of species is utilized to develop criteria and these species are intended to be representative of the entire ecosystem, including marine mammals and sea turtles and their prey. These criteria are designed to not only prevent mortality but to prevent all "unacceptable effects," which is defined by EPA to include not only lethal effects but also effects that impair growth, survival, and reproduction.

As the discharge of TRO will be in compliance with water quality standards, it is reasonable to conclude that it will not cause any consequences to listed species including effects that impact health, impair growth, survival and reproduction of any NMFS listed species and their prey. Therefore, the effect of the discharge of these pollutants at levels that are less than the relevant water quality standards, which by design are consistent with, or more stringent than EPA's aquatic life criteria, are extremely unlikely to affect any ESA listed species and effects will be discountable.

Discharge of Heated Effluent

Heated effluent would be discharged from the OCS-DC1 station d. The draft EPA permit limits the maximum daily discharge temperature to 83.3° F (28.5°C), with an average monthly limit of 79.5°F; the draft permit requires continuous temperature monitoring. As described in the draft EPA permit, SouthCoast Wind conducted an assessment of the thermal impacts on the receiving water of heated effluent from the OCS-DC1. In the assessment, SouthCoast Wind summarized the results of the thermal modeling based on a projected maximum daily effluent temperature of 86° F (30°C). The analysis used a temperature differential of 1° (1.8°F) to determine the extent of the thermal plume, which EPA notes is consistent with EPA's Gold Book (NPDES Permit No. MA0006018).

For the thermal plume analysis, SouthCoast Wind used the following approach: (1) the Cornell Mixing Zone Expert System (CORMIX) to model dilution of the heated discharge, (2) site-specific metocean data provided by SouthCoast Wind to identify and calculate the velocity, temperature, and salinity model input parameters for the CORMIX mixing zone model, and (3) data outputs from the Hybrid Coordinate Ocean Model (HYCOM) to help support defining the ambient condition and hydrodynamic characteristics for each season. The thermal plume was evaluated seasonally (i.e., fall, winter, spring, summer) for the highest temperature deltas between ambient and the thermal effluent (i.e., lowest ambient temperatures), which occurs during winter (39.6°F/4.2°C) and spring (38.6°F/3.7°C). The model was run using the maximum effluent discharge flow of 9.9 MGD and maximum discharge water temperature of 86°F (30°C) for each of the four seasons.

As described by EPA, the model results suggest that the thermal plume (at a maximum discharge temperature of 86°F) is generally in the range of 42 feet (13 m) to 85 feet (26 m) long, and between 11 feet (3.4 m) and 29 feet (8.7 m) wide, when the temperature delta is 1°C (1.8°F). The largest extent of the plume (about 792.1 ft^2 ($73.6 m^2$)) is expected to occur during winter. Generally, the modeled plume is fully mixed within about 85 ft (26 m) of the outfall. The plume is slightly buoyant but becomes fully mixed within a depth of about 30 feet (9 m) of the outfall. The plume is expected to mix relatively quickly. For perspective, the expected area of the plume under the worst-case condition is about 0.2% of the area encompassed by the foundation (including scour protection) of the OCS-DC1 (39,619 m^2 or 9.79 acres), and the length of the plume is about 1.4% of the expected distance between WTGs (1,851 m or 1.15 miles). Based on this, EPA determined that mobile organisms are expected to be able to avoid the thermal plume by swimming around, above, or below the plume.

Based on the results of the CORMIX modeling, the discharge occurring in compliance with the maximum daily temperature limit of 86°F will result in a relatively small thermal plume that, under worst-case conditions during spring slack tide (as described by EPA), will be within 1.8°F of the ambient temperature within 85 m of the outfall with a total mixing area of about 73.6 m^2. In addition, based on the projected extent of the thermal plume, the daily temperature cycles that are characteristic of the area will not be altered in either magnitude or frequency. As such, as noted by EPA, the proposed thermal discharge limits are expected to protect the marine community from adverse thermal effects. The Draft EPA Permit requires that temperature be monitored using an automated meter on a continuous basis. In addition, the Draft Permit proposes that the Permittee complete an ambient thermal monitoring study to confirm that the extent and magnitude of the thermal plume is equal to or less than modeling results. Water quality monitoring including documentation of the extent of the thermal plume is required to occur during the spring of the second year following the start of full-scale operations. Sampling must be conducted within 3.1 hours before or after slack tide.

Thermal Plume – Effects to Listed Species

Given the small size of the plume, we expect that a whale, sea turtle, or Atlantic sturgeon could easily avoid it by swimming around, above, or below the plume. If an animal did encounter and avoid the area, the effects of that avoidance would be a very slight change in direction to swim around, under, or above the plume. Any effects to any whale, sea turtle, or Atlantic sturgeon would be so small that they could not be meaningfully measured, evaluated, or detected, and therefore would be insignificant. We also note that even if an individual swam through the thermal plume, no adverse effects would be expected; this is because the temperature is not so high as to cause thermal stress from the short period of exposure (noting that the maximum temperature of 86°F would only be experienced within a very small area, extending less than 10 m from the discharge point). Further, the area affected is so small that the existence of the thermal plume would not result in any changes in use of the area. Specifically, sea turtles would not be expected to seek out thermal refuge in this area and then stay longer in the WDA in the winter months than they otherwise would; this is because the area where an increase in water temperature would be experienced is very small. Given the small area that the thermal discharge will cause to have elevated water temperatures (area not exceeding 73.6 m^2), it is extremely unlikely that there will be any effects to any ESA listed species and even if they did occur, they would be insignificant.

Thermal Plume - Effects to Prey

As mentioned above, the thermal plume (i.e., the area with water temperatures greater than 1C above ambient) will not exceed 73.6 m^2. Given the small size of the thermal plume, we expect any mobile organisms to readily avoid it by swimming under, around, or above the plume. Even considering drifting or less mobile prey species, considering the small size of the thermal plume and the maximum temperature of 86°C, we do not expect the mortality of prey species to result from exposure to the thermal plume. Further, the thermal plume will not extend to the bottom of the water column and therefore will not affect benthic resources. As we do not anticipate any loss of prey resources due to exposure to the thermal plume, effects to listed species are extremely unlikely to occur and are discountable.

7.5 Effects of Marine Resource Survey and Monitoring Activities

SouthCoast Wind will carry out survey and monitoring activities in and near the SouthCoast Wind WDA. As described in Section 3.0 *Description of Proposed Action*, these will include: otter trawls, ventless trap surveys, neuston net sampling, drop cameras, acoustic telemetry to characterize fisheries resources in the WDA; benthic monitoring to document the disturbance and recovery of marine benthic habitat and communities resulting from the construction and installation of SouthCoast Wind project components in the WDA and along the offshore export cable corridors; and PAM to characterize the presence of marine species (e.g., marine mammals and cod).

In this section, we consider the effects of the marine resource survey and monitoring activities on listed species in the action area by describing the effects of potential interactions between listed species and proposed survey gear and the other sampling and monitoring methodologies, and then analyze risk and determine likely effects to sea turtles, listed whales, and Atlantic sturgeon. Section 7.1 *Effects of the Action - Underwater Noise* of the Opinion addresses the effects of noise during surveys, including HRG surveys; as noted there, the operating frequencies of the SSS and/or MBES equipment proposed for use in the benthic monitoring mean that no effects to ESA listed species will occur even if individuals are exposed to the noise from that equipment. Effects of Project vessels, including the ones that will be used for survey and monitoring activities are considered in Section 7.2 *Effects of the Action – Effects of Project Vessels*, above, and are not repeated here.

7.5.1 Assessment of Effects of Benthic Monitoring, Acoustic Telemetry Monitoring, Neuston Net Surveys, PAM, and Buoy Deployments

Benthic Sampling

SouthCoast Wind is proposing to conduct benthic monitoring to document the disturbance and recovery of marine benthic habitat and communities resulting from the construction and installation of Project components, including WTGs, OSPs, and their scour protection as well as the inter-array cabling and export cable corridors from the WFA to shore. Monitoring will be conducted using a combination of acoustic survey and remotely operated vehicle imaging techniques, along with grab sampling techniques. The monitoring will occur in late spring and early fall each year. These will supplement initial surveys conducted along the Brayton Point ECC in summer 2021 and spring 2022. The initial baseline survey in the WFA will occur during the first available survey period (i.e., late spring and early fall) following construction. The survey will then be repeated once: three years following construction. Results of the three-year post construction monitoring will be reviewed, and an additional monitoring survey will be completed five years post construction, if needed. Therefore, the action considered here includes three spring surveys and three fall surveys (i.e. fall and spring baseline, three-year and five year). Along the ECC in Rhode Island state waters, targeted studies will be designed and carried out to monitor areas where complex habitats occur and where project boulder relocation activities are expected to occur prior to cable installation (i.e. region northeast of Mount Hope Bridge, the pocket of Glacial Moraine west of Sakonnet Point, and the area near the Rhode Island state waters demarcation). To assess the effect of the introduction of hard-bottom novel surfaces in the WFA, a ROV stereo-camera system will be used to measure changes in benthic percent cover, identify key or dominant species, document non-native/invasive species, and compare findings across water depths in a stratified-random sampling design. To evaluate structure-oriented enrichment, sediment grab samples and SPI/PV will be used to measure changes in benthic function over time and with distance from foundations. ROV stereo camera surveys will monitor novel hard bottom habitats within subareas of the Project area, at structures selected using a stratified random design.

The ROV video and SPI/PV surveys will result in temporary disturbance of the benthos and temporary loss of benthic resources in the disturbed areas. ROV operation and SPI/PV surveys will affect an extremely small area at each survey location (~1.5 m^2). Any loss of benthic resources will be small, temporary, and localized to the areas disturbed by survey activities;

recolonization is expected to be rapid. These temporary, isolated reductions in the amount of benthic resources are not likely to have a measurable effect on any foraging activity or any other behavior of listed species; this is due to the small size of the affected areas and the temporary nature of any disturbance. As such, effects to listed species that may forage on these benthic resources (i.e., Atlantic sturgeon and some sea turtles) will be so small that they cannot be meaningfully measured, detected, or evaluated: effects are insignificant and thus not likely to adversely affect any listed sea turtles or Atlantic sturgeon. These surveys will have no effects on any ESA listed whales.

Acoustic Telemetry Monitoring
SouthCoast Wind will maintain twelve acoustic telemetry receivers in Rhode Island waters along the SouthCoast Wind ECC to Brayton Point. This telemetry monitoring is designed to complement existing acoustic telemetry surveys in the region. The receiver array will be deployed in the spring and retrieved in the fall each year over a five-year survey period. Each receiver will be equipped with a ropeless recovery mooring system and will be retrieved and re-deployed each time. Target fish species in the area around the receiver array will be captured via rod-and-reel, implanted with acoustic transmitters, and released back into the ocean. Atlantic sturgeon and sea turtles are occasionally captured with rod and reel; however, these events are generally rare in New England waters. We have determined that capture of any sea turtles or Atlantic sturgeon is extremely unlikely to occur. This is because of the limited amount of fishing effort, the short set time for rod and reel fishing (only a few minutes), and the dispersed nature of sea turtle and sturgeon occurrence in the area where surveys will occur which makes co-occurrence extremely unlikely. Based on this analysis, effects to Atlantic sturgeon and sea turtles are extremely unlikely to occur and therefore, discountable: adverse effects to these species are not likely to occur. No interactions between the rod and reel fishing activities and ESA listed whales are anticipated: these activities will therefore have no effects on these species. The receivers for these surveys will be set using ropeless technology; this means that there will be no vertical lines associated with the moorings and therefore, no risk for entanglement of listed species in the mooring systems. Operationally, the acoustic receiver devices just record the presence of nearby tagged animals by detecting signals sent by tags. No effects to ESA listed species are anticipated to result from acoustic telemetry surveys other than general vessel activities, the effects of which are considered in Section 7.2 *Effects of the Action – Effects of Project Vessels* above. This is because no listed species will be tagged and the deployed receivers will utilize ropeless technology negating any entanglement risk, and there are no effects to ESA listed species from this type of passive monitoring.

Drop Camera
SouthCoast Wind is proposing to conduct drop camera surveys coordinated with University of Massachusetts Dartmouth School for Marine Science and Technology (SMAST). Three cameras recording both digital still and video will be deployed to identify substrate as well as invertebrate and fish species associated with the sea floor. The survey will occur twice per year over five years in late-Summer between April and September each year. SouthCoast Wind will choose 126 impact sites and 134 control sites, for a total of 520 average annual samples (260 sampling stations per survey) over the WFA and control sites seen in Figure 3.4. Cameras, sampling pyramids, and lights will be deployed from a commercial scallop fishing vessel and the survey period will last approximately four to five days. A drop camera pyramid will be deployed four

times, roughly 164 feet (50 meters) apart, at each station. The pyramid will be equipped with two downward-looking cameras to provide quadrat 68 samples of the seafloor for all stations. Additionally, a third camera with a 6.5 square foot (0.6 square meter) view of the seafloor or a view parallel to the seafloor will also be deployed. At each station, images will be collected for laboratory review. Within each quadrat, epibenthic invertebrates (comprised of 50 total taxa that can include squid egg clusters or other organisms of interest) will be counted or noted as present and the substrate will be identified.

No effects to ESA listed species are anticipated to result from the drop camera surveys other than general vessel activities, the effects of which are considered in Section 7.2 *Effects of the Action – Effects of Project Vessels* above.

Neuston Net Sampling

Zooplankton sampling will occur concurrent with the ventless trap surveys to determine the relative abundance and distribution of the larvae of commercially fished crustaceans. The surveys will use a towed neuston net and sample the top 0.5 m of the water column. At each ventless trap survey station (30 total), one ten-minute tow will be conducted at a target speed of four knots to assess pre-settlement and abundance of plankton resources in the SouthCoast Wind WFA and the adjacent control area (see Figure 3.4). The 2.4 m x 0.6 m x 6 m sampling net made with 1,320-microfiber mesh will be deployed off the stern of commercial fishing vessels twice per month from May to October during baiting and setting of ventless trap gear.

The small size of the sampling net, relative location of the sampling net in the water column, short tow times, and slow operational speeds makes the risk of capture of any ESA listed sea turtle or Atlantic sturgeon species extremely unlikely to occur; listed whales are too large to be captured by the sampling net. Based on the analysis herein, it is extremely unlikely that any ESA listed species will interact with the plankton survey activities; any effects to ESA listed species of the zooplankton survey activates are extremely unlikely to occur and thus discountable: these activities are thus not likely to adversely affect any ESA-listed species.

Passive Acoustic Monitoring

Moored PAM systems or autonomous PAM devices will be deployed prior to, during, and following construction of the SouthCoast Wind project to characterize the presence of marine species such as marine mammals and cod through passive detection of vocalizations. PAM will also be used to record ambient noise, project vessel noise, pile driving noise, and WTG operational noise. These systems may include both near real-time and archival PAM devices for mitigation monitoring and long term monitoring, respectively. Moored PAM systems are stationary and may include platforms that reside completely underwater with no surface expression (i.e., HARPs, high-frequency acoustic recording packages) or may consist of buoys (at the surface) connected via a data and power cable to an anchor or bottom lander on the seafloor. Moored PAM systems will use the best available technology to reduce any potential risks of entanglement and deployment will comply with best management practices designed to reduce the risk of entanglement in anchored monitoring gear (see Appendix B of NMFS 2021a, Appendix C to this Opinion). For moored PAM systems, there are cables connecting the hydrophones and/or buoy to the anchor or lander; however, entanglement is extremely unlikely to occur. The cables associated with moored systems have a minimum bend radius that minimizes entanglement risks and does not create loops during deployment, further minimizing entanglement risks. There are no records of any entanglement of listed species in moored PAM systems, and we do not anticipate any such entanglement will occur.

Mobile systems may include autonomous PAM devices (e.g. gliders) that may operate at the surface or operate throughout the water column. These vehicles produce virtually no self-generated noise and travel at slow operational speeds (~0.25 m/s) as they collect data. Moored and mobile systems will be deployed and retrieved by vessels; maintenance will also be carried out from vessels. Potential effects of vessel traffic for all activities considered in this consultation are addressed in Section 7.2 *Effects of the Action – Effects of Project Vessels*. The small size and slow operational speeds of mobile PAM systems make the risk of a collision between the system and a listed species extremely unlikely to occur. Even in the extremely unlikely event that a whale, sea turtle, or Atlantic sturgeon bumped into the mobile PAM system, it is extremely unlikely that there would be any consequences to the individual because of the relative lightweight of the mobile PAM system, slow operating speeds, small size, and rounded shape.

Based on the analysis herein, it is extremely unlikely that any ESA listed species will interact with any PAM system; any effects to ESA listed species of the PAM monitoring are extremely unlikely to occur and are therefore, discountable. The deployment, use, maintenance and retrieval of PAM systems and devices are therefore unlikely to affect any ESA-listed species.

Other Buoy Deployments
BOEM has indicated that one or more data collection buoys may be deployed in the WDA to provide weather and other data in the project area. Best management practices for moored buoys used for data collection associated with offshore wind projects are described in the June 29, 2021 informal programmatic consultation between NMFS/GARFO and BOEM on certain geophysical and geotechnical survey activities and data collection buoy deployment (see Appendix C of this Opinion). The minimization measures in Appendix C are incorporated as elements of the proposed action for this opinion. BOEM has indicated that any data collection buoys deployed as part of the SouthCoast Wind project will be consistent with the best management practices and project design criteria included in the June 2021 consultation. Therefore, consistent with the conclusions of the 2021 programmatic, we expect any effects to ESA listed species to be extremely unlikely to occur and therefore, discountable. Buoy deployment, use, and retrieval are not likely to adversely affect any ESA listed species.

7.5.2 Assessment of Risk of Interactions with Otter Trawl Gear
SouthCoast Wind will conduct 5 years of otter trawl surveys (2 years pre-construction, 1 year during construction, and 2 years post-construction) to assess the finfish communities in the SouthCoast WFA and the adjacent control areas. As described in Section 3.0 *Description of Proposed Action*, the surveys will be adapted to Northeast Area Monitoring and Assessment Program (NEAMAP) protocols. Surveys will be conducted seasonally during spring (April-June), summer (July-September), fall (October-December) and winter (January-March). A total of 240 tows each year (60 trawls per season) will be split evenly between the SouthCoast Wind WFA and the three control areas. All surveys across the SouthCoast Wind WFA and the control areas will be conducted during daylight hours (after sunrise and before sunset) for 20 minutes

each with a target tow speed of 3.0 knots. All survey activity will take place within the action area.

ESA Listed Whales

Factors Affecting Interactions and Existing Information on Interactions
Entanglement or capture of ESA listed North Atlantic right, fin, sei, blue, and sperm whales in beam or bottom otter trawl gear is extremely unlikely. While these species may occur in the study area where survey activities will take place, otter trawl gear is not expected to directly affect right, fin, sei, blue, and sperm whales given that these large cetaceans have the speed and maneuverability to get out of the way of oncoming gear, which is towed behind a slow moving vessel (less than 4 knots). There have been no observed or reported interactions of right, fin, sei, blue, or sperm whales with otter trawl gear (NEFSC observer/sea sampling database, unpublished data; GAR Marine Animal Incident database, unpublished data). The slow speed of the trawl gear being towed and the short tow times further reduce the potential for entanglement or any other interaction. In addition, before gear is set, project staff would monitor the area for protected species and not deploy the net if any are sighted in the general vicinity (500 m) around the survey vessel. As a result, we have determined that it is extremely unlikely that any large whale would interact with the trawl survey gear: these trawls are thus are not likely to adversely affect any ESA-listed whale species.

Effects to Prey
The proposed bottom trawl survey activities will not have any effects on the availability of prey for right, fin, sei, blue and sperm whales. Right whales and sei whales feed on copepods (Perry et al. 1999). Copepods are very small organisms that will pass through trawl gear rather than being captured in it. In addition, copepods will not be affected by turbidity created by the gear moving through the water. Fin whales feed on krill and small schooling fish (e.g., sand lance, herring, mackerel) (Aguilar 2002). Blue whales feed on krill. The trawl gear to be used in the SouthCoast Wind survey activities operates on or very near the bottom, while schooling fish such as herring and mackerel occur higher in the water column. Sand lance inhabit both benthic and pelagic habitats, however, they typically bury into the benthos and would not be caught in the trawl. Sperm whales feed on deep-water species that do not occur in the area to be surveyed. If any prey species do get caught in the trawl net, it would occur infrequently and would be relatively few.

Sea Turtles

Factors Affecting Interactions and Existing Information on Interactions
Sea turtles forcibly submerged in any type of restrictive gear can eventually suffer fatal consequences from prolonged anoxia and/or seawater infiltration of the lung (Lutcavage and Lutz 1997; Lutcavage et al. 1997). A study examining the relationship between tow time and sea turtle mortality in the shrimp trawl fishery showed that mortality was strongly dependent on trawling duration, with the proportion of dead or comatose sea turtles rising from 0% for the first 50 minutes of capture to 70% after 90 minutes of capture (Henwood and Stuntz 1987). Following the recommendations of the NRC to reexamine the association between tow times and sea turtle deaths, the data set used by Henwood and Stuntz (1987) was updated and re-analyzed

(Epperly et al. 2002; Sasso and Epperly 2006). Seasonal differences in the likelihood of mortality for sea turtles caught in trawl gear were apparent. For example, the observed mortality exceeded 1% after 10 minutes of towing in the winter (defined in Sasso and Epperly (2006) as the months of December-February), while the observed mortality did not exceed 1% until after 50 minutes in the summer (defined as March-November; Sasso and Epperly 2006). In general, tows of short duration (<10 minutes) in either season have little effect on the likelihood of mortality for sea turtles caught in the trawl gear and would likely achieve a negligible mortality rate (defined by the NRC as <1%). Longer tow times (up to 200 minutes in summer and up to 150 minutes in winter) result in a rapid escalation of mortality, and eventually reach a plateau of high mortality, but will not equal 100%, as a sea turtle caught within the last hour of a long tow will likely survive (Epperly et al. 2002; Sasso and Epperly 2006). However, in both seasons, a rapid escalation in the mortality rate did not occur until after 50 minutes (Sasso and Epperly 2006) as had been found by Henwood and Stuntz (1987). Although the data used in the NRC reanalysis were specific to bottom otter trawl gear in the U.S. South Atlantic and Gulf of Mexico shrimp fisheries, the authors considered the findings to be applicable to the impacts of forced submergence in general (Sasso and Epperly 2006).

Sea turtle behaviors may influence the likelihood of them being captured in bottom trawl gear. Video footage recorded by the NMFS Southeast Fisheries Science Center (SEFSC) Pascagoula Laboratory indicated that sea turtles will keep swimming in front of an advancing shrimp trawl, rather than deviating to the side, until they become fatigued and are caught by the trawl or the trawl is hauled up (NMFS 2002). Sea turtles have also been observed to dive to the bottom and hunker down when alarmed by loud noise or gear (Memo to the File, L. Lankshear, December 4, 2007), which could place them in the path of bottom gear such as a bottom otter trawl. There are very few reports of sea turtles dying during research trawls. Based on the analysis by Sasso and Epperly (2006) and Epperly et al. (2002) as well as information on captured sea turtles from past state trawl surveys and the NEAMAP and NEFSC bottom trawl surveys, tow times less than 30 minutes are expected to eliminate the risk of death from forced submergence for sea turtles caught in beam and bottom otter trawl survey gear.

During the spring and fall bottom trawl surveys conducted by the NEFSC from 1963-2017, 85 loggerhead sea turtles were captured. Only one of the 85 loggerheads suffered injuries (cracks to the carapace) causing death. All others were alive and returned to the water unharmed. One leatherback and one Kemp’s ridley sea turtle have also been captured in the NEFSC bottom trawl surveys and both were released alive and uninjured. NEFSC bottom trawl survey tows are approximately 30 minutes in duration. All 50 loggerhead, 34 Kemp’s ridley, and one green sea turtles captured in the NEAMAP surveys since 2007 have also been released alive and uninjured. NEAMAP surveys operate with a 20-minute tow time. Swimmer et al. (2014) indicates that there are few reliable estimates of post-release mortality for sea turtles because of the many challenges and costs associated with tracking animals released at sea. However, based on the best available information as cited herein, we anticipate that post-release mortality for sea turtles in bottom otter trawl gear where tow times are short (less than 30 minutes) is minimal to non-existent unless the turtle is already compromised to begin with. In that case, the animal would likely be retained onboard the vessel and transported to a rehabilitation center rather than released back into the water.

Estimating Interactions with and Mortality of Sea Turtles
We have considered the available data sets to best predict the number of sea turtles that may be incidentally captured in the proposed trawl surveys. The largest and longest duration data sets for surveys in the general area of the SouthCoast Wind WDA are the NEAMAP and NEFSC bottom trawl surveys. Both surveys occur in the spring and fall using trawl gear.

The NEFSC bottom trawl surveys use a 4-seam, 3-bridle bottom trawl to monitor abundance and distribution of mature and juvenile fish and invertebrates. The survey operates from Cape Hatteras to the Western Scotian Shelf and targets 800 tows per year over approximately 120 days at sea. The spring survey occurs from March to May, occasionally to June, and the fall survey occurs from September to November. In various forms, these surveys have been ongoing since 1963. Due to vessel and equipment limitations, the depth range minimum for more recent years is at least 18 m (60 feet).

The NEAMAP near Shore Trawl Program is conducted in the spring (April – June) and fall (October – December). Each cruise samples approximately 150 stations across 15 regions from Cape Hatteras, NC north to Cape Cod, MA. Surveys occur in depths to 60 feet and includes the sounds to 120 feet (see map at https://www.vims.edu/research/units/programs/multispecies_fisheries_research/neamap/stations/index.php). This survey has been ongoing since 2007.

The NEAMAP survey area is inshore of and does not overlap with the area that will be sampled for the SouthCoast Wind trawl surveys. The NEFSC survey area occurs farther offshore and overlaps with the WFA. We have also considered information on interactions with sea turtles and commercial trawl fisheries available from fisheries observer data (Murray 2020).

We reviewed records for sea turtles captured in the NEFSC spring (March-May) and fall (September-October) trawl surveys from 2012-2022 for trawls above 39° N (excluding the Gulf of Maine). This is the geographic area determined to best predict capture rates in a trawl survey carried out in or around the lease areas located in southern New England. For the 2012-2022 fall surveys, three loggerhead sea turtle captures were documented over 1,716 tows; this is a capture rate of 0.00175 loggerhead sea turtles per tow. The NEFSC surveys did not capture any sea turtles during spring surveys in this geographic area; however, the surveys are conducted in early spring, likely before sea turtles arrive in the area. SouthCoast Wind is proposing to carry out 240 tows total over four seasons (60 per season) each year over five years. We do not expect sea turtles to occur in the area during the winter and thus have excluded the tows from the winter season in our interaction estimates. Applying the fall capture rate (0.00175 sea turtles per tow) to the 60 spring, summer and fall tows (180 total) (as we expect similar abundance of sea turtles in the area in the spring, summer and fall months), results in an estimate of 0.315 loggerheads captured per year or 1.57 loggerheads over the five year survey period.

Murray (2020) estimated the interaction rates of sea turtles in the US commercial bottom trawl fisheries along the Atlantic coast between 2014-2018 using fisheries observer data. In this analysis, a total of 5,227 days fished were observed from 2014-2018 in bottom trawl fisheries in the Georges Bank and Mid-Atlantic, which represented 13% of commercial trawl fishing effort across both regions. During this period, NEFOP observers documented 50 loggerhead turtle interactions in bottom trawl gear, 48 of which occurred in the Mid-Atlantic; observers also recorded 5 Kemp's ridley turtles, 3 leatherback turtles, and 2 green turtles. These data overlap temporally and spatially with the survey area and the seasons that surveys will occur; however, there are differences in the trawl gear used in commercial fisheries compared to the gear that will be used in the proposed survey. Therefore, because other data sources are available that better align with the proposed surveys, we are not using the interaction rate for commercial trawl fisheries to predict the number of sea turtles likely to be captured in the SouthCoast Wind surveys. However, we note that the Murray (2020) dataset demonstrates that all the sea turtle species that occur in the survey area are vulnerable to capture in commercial trawl gear.

The SouthCoast Wind trawl survey will use the same trawl design as the NEAMAP survey carried out by the Virginia Institute of Marine Science (VIMS); however, as noted above the NEAMAP survey area does not overlap with the SouthCoast Wind trawl survey areas as the NEAMAP survey area is further inshore. The majority of captures of sea turtles in the NEAMAP survey (2008-2023) have been loggerheads (56), followed by Kemp's ridley (35). Only one green sea turtle has been captured and there have been no captures of leatherback sea turtles. Sea turtles have been captured in the spring and fall surveys. Using this data to calculate a rate of sea turtle captures per tow and applying that to the number of tows planned by SouthCoast Wind, we would predict the capture of 2.10 loggerheads, 1.31 Kemp's ridley, zero leatherbacks, and 0.038 green sea turtles per year. Over the five-year survey period, we would predict the capture of 11 loggerheads, 7 Kemp's ridley, zero leatherbacks, and 1 green sea turtle.

As explained above, we do not consider it reasonable to use commercial fisheries bycatch data to predict risk of capture in the trawl survey; this is due to significant differences in operational protocols. As explained above, both the NEFSC trawl surveys and NEAMAP trawl surveys operate with similar gear and survey protocols as those planned for the SouthCoast Wind survey, with the SouthCoast Wind survey specifically designed to mimic the NEAMAP protocols. The SouthCoast Wind survey will occur outside (further offshore) of the area sampled in the NEAMAP survey and the depths in the area to be surveys are deeper than those targeted by the NEAMAP survey. The NEAMAP survey occurs in more inshore waters and, in most areas, with depths less than 60 feet while the NEFSC survey has a minimum survey depth of 60 feet. Depths in the SouthCoast Wind survey area range from 122 feet to 208 feet (BA Section 4.2). The depths and location of the area where the SouthCoast Wind surveys will take place suggests that the NEFSC survey data would be a better predictor of sea turtle interactions than the NEAMAP survey. We note that neither survey has ever captured a leatherback sea turtle; therefore, despite Murray (2020) documenting past captures of leatherback sea turtles in commercial trawl gear nor predicting future interaction rates, we do not expect the SouthCoast Wind survey to result in the capture of a leatherback sea turtle. We have also considered data from surveys being carried out in nearby wind lease areas; surveys have been ongoing in the Vineyard Wind 1 lease area and the South Fork lease area since fall 2021, and more recently in the Revolution Wind lease area and the Sunrise Wind lease area since fall 2023. To date, no captures of sea turtles in these trawl surveys have been recorded. We note that two (live, uninjured) loggerheads were collected in Ocean Wind 1's fall 2023 trawl survey; however, that survey area is hundreds of miles south of the SouthCoast Wind survey area where sea turtles are generally more common. Based on our consideration of the best available information, as laid out here, we consider the NEFSC trawl survey data to be the best means to predict future captures of sea turtles in the SouthCoast Wind trawl surveys. As such, we expect the capture of up to 2 sea turtles over the 5 year survey period (Table 7.5.1). These are most likely to be loggerheads but given the distribution of other sea turtle species in the area and the documented interactions with trawl survey gear, it is also possible that these could be other hard-shell species (Kemp's ridley or green sea turtles).

Based on the analysis by Sasso and Epperly (2006) and Epperly et al. (2002) discussed above, as well as information on captured sea turtles from past state trawl surveys and the NEAMAP and NEFSC trawl surveys (no mortalities or serious injuries), the 20-minute tow time for the bottom trawl gear to be used in the proposed SouthCoast surveys is expected to eliminate the risk of serious injury and mortality from forced submergence for sea turtles caught in the bottom trawl gear. Additionally, survey staff will prioritize handling of any protected species that are captured in the trawl net. We expect that effects to sea turtles captured in the trawl survey will be limited to minor abrasions from the nets and that these minor injuries will be fully recoverable with no impacts to the health or fitness of any individual. No serious injury or mortality of any sea turtle is anticipated to occur as a result of the trawl surveys and all captured turtles are expected to be quickly released back into the water alive.

Table 7.5.1. Estimated captures of sea turtles by species from SouthCoast Wind trawl surveys over the five-year duration

Species	**Total Estimated Captures Over Five Years**
Hard shells (Loggerhead, Kemp's ridley, or Green)	2
Leatherback	0

Effects to Prey

Sea turtle prey items such as horseshoe crabs, other crabs, whelks, and fish are removed from the marine environment as bycatch in bottom trawls. None of these are typical prey species of leatherback sea turtles or of neritic juvenile or adult green sea turtles. Therefore, the SouthCoast Wind trawl surveys will not affect the availability of prey for leatherback and green sea turtles in the action area. Neritic juveniles and adults of both loggerhead and Kemp's ridley sea turtles are known to feed on these species that may be caught as bycatch in the bottom trawls. However, all bycatch is expected to be returned to the water alive, dead, or injured to the extent that the organisms will shortly die. Injured or deceased bycatch would still be available as prey for sea turtles, particularly loggerheads, which are known to eat a variety of live prey as well as scavenge dead organisms. Given this information, any effects on sea turtles from collection of potential sea turtle prey in the trap/pot gear will be so small that they cannot be meaningfully measured, detected, or evaluated and, therefore, effects are insignificant.

Atlantic Sturgeon

Factors Affecting Interactions and Existing Information on Interactions

Atlantic sturgeon are generally benthic oriented but while migrating, Atlantic sturgeon may be present throughout the water column and could interact with trawl gear while it is moving through the water column. Atlantic sturgeon interactions with beam and bottom trawl gear are likely at times when and in areas where their distribution overlaps with the operation of the gear. Adult and subadult Atlantic sturgeon may be present in the areas to be surveyed year-round. In the marine environment, Atlantic sturgeon are most often captured in depths less than 50 m. Some information suggests that captures in otter trawl gear are most likely to occur in waters with depths less than 30 m (ASMFC TC 2007). The capture of Atlantic sturgeon in otter trawls used for commercial fisheries is well documented (see for example, Stein et al. 2004b and ASMFC TC 2007).

NEFOP data from Miller and Shepherd (2011) indicates that mortality rates of Atlantic sturgeon caught in commercial otter trawl gear is approximately 5 percent. Atlantic sturgeon are also captured incidentally in trawls used for scientific studies, including the standard NEFSC bottom trawl surveys and both the spring and fall NEAMAP bottom trawl surveys. The shorter tow durations and careful handling of any sturgeon once on deck during fisheries research surveys, compared to commercial fishing operations, is likely to result in an even lower potential for mortality, as commercial fishing trawls tend to be significantly longer in duration. None of the hundreds of Atlantic and shortnose sturgeon captured in past state ocean, estuary, and inshore trawl surveys have had any evidence of serious injury and there have been no recorded mortalities. Both the NEFSC and NEAMAP surveys have recorded the capture of hundreds of Atlantic sturgeon since the inception of each. To date, there have been no recorded serious injuries or mortalities. In the Hudson River, a trawl survey that incidentally captures shortnose and Atlantic sturgeon has been ongoing since the late 1970s; hundreds of individuals of a wide range of sizes have been captured with no mortalities recorded. To date, no serious injuries or mortalities of any sturgeon have been recorded in those surveys.

Estimating Interactions with and Mortality of Sturgeon

We have considered the available data sets to best predict the number of Atlantic sturgeon that may be incidentally captured in the proposed trawl surveys. The largest and longest duration data sets for surveys in the general area of the SouthCoast Wind WDA are the NEAMAP and NEFSC bottom trawl surveys. The NEAMAP survey area is farther inshore and does not overlap with the SouthCoast Wind survey area while the NEFSC survey area occurs farther offshore and overlaps with the area within the WFA where the trawl survey is proposed.

We reviewed records for Atlantic sturgeon captured in the NEFSC spring (March-May) and fall (September-October) trawl surveys from 2012-2022 for trawls above 39° N (excluding the Gulf of Maine); this geographic area was considered the best predictor for interaction rates in the southern New England wind energy areas. Three Atlantic sturgeon were captured in the spring surveys from 2012-2022; considering the total of over 1,796 tows, this results in an interaction rate of 0.00167 sturgeon per tow. During these same years, 1 Atlantic sturgeon was captured in the fall surveys; considering the total of over 1,716 tows, this results in an interaction rate of 0.00058 sturgeon per tow. Averaging the two interaction rates for a yearly rate, results in an interaction rate of 0.00113 sturgeon per tow. Applying the NEFSC annual interaction rate (0.00113 sturgeon/tow) to the 240 tows planned for the SouthCoast Wind trawl surveys results in an estimate of 0.270 Atlantic sturgeon captured per year, and 1.35 over 5 years. This was further broken down by each sturgeon DPS, resulting in an estimate of 0.75 sturgeon from the New York Bight DPS, 0.31 sturgeon from the Chesapeake DPS, 0.18 sturgeon from the South Atlantic DPS, 0.08 sturgeon from the Carolina DPS, and 0.02 sturgeon from the Gulf of Mine DPS. Because we round fractions of animals to a whole number, this results in 1 sturgeon from each DPS over the 5 year length of the survey, for a total of 5 Atlantic sturgeon across all DPSs.

The NEAMAP survey has captured 546 sturgeon from 2008-2023 and averages 300 tows per year, this equates to a capture rate of 0.114 sturgeon per tow. Using this data, we would predict the capture of 28 Atlantic sturgeon per year in the SouthCoast Wind surveys, resulting in a total predicted capture of 140 Atlantic sturgeon over the course of the five-year survey period.

As noted above, trawl surveys are underway in the South Fork, Vineyard Wind 1, Revolution Wind, and Sunrise Wind lease areas, with the Revolution Wind and Sunrise Wind surveys having completed only one season to date (Fall 2023). To date, five Atlantic sturgeon have been captured in the South Fork trawl surveys (2 in May 2022, 1 in July 2022, and 2 in May 2023). Even though SouthCoast Wind will be using the same methodology as South Fork, the SouthCoast trawl surveys both within the WDA and the control areas will be conducted further offshore where it is less likely to interact with Atlantic sturgeon.

As noted above, we are not aware of any other survey data that could be used to predict interaction rates for Atlantic sturgeon in the SouthCoast Wind lease area. The Massachusetts nearshore trawl survey occurs in waters inshore of the SouthCoast Wind survey area (see map of 2023 sample locations at https://www.mass.gov/files/documents/2023/07/11/MLA_Letter_fall_2023.pdf). Dunton et al. (2015) calculated catch per unit effort (CPUE; fish per minute towed) for Atlantic sturgeon captured in trawls off the south coast of Long Island; CPUE is reported for both trawls carried out in a stratified random sampling design and trawls targeting Atlantic sturgeon. The study reports catch of 149 Atlantic sturgeon for 10,380 minutes of trawling in the stratified random sampling design; this translates to 0.0144 Atlantic sturgeon/minute. CPUE from targeted trawling was 0.226 sturgeon/minute. The area surveyed by Dunton is a high use area for Atlantic sturgeon and thus is not expected to be representative of catch rates in the SouthCoast Wind survey area where Atlantic sturgeon are expected to be transient and be less common given the deeper, more offshore location.

Given the geographic distribution of the proposed SouthCoast Wind surveys, it is likely that the number of Atlantic sturgeon captured would be closer to the number predicted using the NEFSC dataset instead and the NEAMAP dataset. Therefore, absent any other data source, we have determined that using the NEFSC data provides the best predictor of the number of Atlantic sturgeon likely to be captured in the Atlantic Shores trawl surveys. As such, we expect up to 5 Atlantic sturgeon will be captured over the five-year survey period.

As explained in Section 5.0 *Status of Species*, the range of all five DPSs overlaps and extends from Canada through Cape Canaveral, Florida. Atlantic sturgeon originating from all five DPSs use the area where trawl gear will be set. The best available information on the composition of the mixed stock of Atlantic sturgeon in Atlantic coastal waters is the mixed stock analysis carried out by Kazyak et al. (2021). The authors used 12 microsatellite markers to characterize the stock composition of 1,704 Atlantic sturgeon encountered across the U.S. Atlantic Coast and provide estimates of the percent of Atlantic sturgeon that belong to each DPS in a number of geographic areas. This study confirmed significant movement of sturgeon between regions irrespective of their river of origin. The SouthCoast Wind survey area falls within the "MID Offshore" area described in that paper. Using that data, we expect that Atlantic sturgeon in the area where trawl surveys will occur originate from the five DPSs at the following frequencies: New York Bight (55.3%), Chesapeake (22.9%), South Atlantic (13.6%), Carolina (5.8%), and Gulf of Maine (1.6%) DPSs (Table 7.5.2). It is possible that a small fraction (0.7%) of Atlantic sturgeon in the action area may be Canadian origin (Kazyak et al. 2021); Canadian-origin Atlantic sturgeon are not listed under the ESA. This represents the best available information on the likely genetic makeup of individuals occurring in this area. Using these percentages we predict that the up to 5 Atlantic sturgeon expected to be captured in the SouthCoast Wind trawl surveys over the 5-year survey period and will consist of individuals from the 5 DPSs as described in Table 7.5.2 below. Based on the information presented above and in consideration of the short tow times (20 minutes) and priority handling of any protected species that are captured in the trawl net, we do not anticipate the serious injury or mortality of any Atlantic sturgeon captured in the trawl gear. Individuals may experience minor abrasions or scrapes but these are expected to be fully recoverable in a short period of time with no effects on individual health or fitness.

Table 7.5.2. Estimated capture of Atlantic sturgeon by DPS in SouthCoast Wind trawl survey. DPS percentages listed are the percentage values representing the genetics mixed stock analysis results (Kazyak et al. 2021). Fractions of animals are rounded to whole animals to generate the total estimate.

Bottom Trawl	**Total Estimated Captures Over Five Years**
Total	5
New York Bight (55.3%)	3
Chesapeake (22.9%)	1
South Atlantic (13.6%)	1*
Carolina (5.8%)	1*
Gulf of Maine (1.6%)	1*

Estimates derived from NEFSC trawl surveys

*1 Atlantic sturgeon from the South Atlantic or Carolina or Gulf of Maine DPS

Effects to Prey

The effects of bottom trawls on benthic community structure have been the subject of a number of studies. In general, the severity of the impacts to bottom communities is a function of three variables: (1) energy of the environment, (2) type of gear used, and (3) intensity of trawling. High-energy and frequently disturbed environments are inhabited by organisms that are adapted to this stress and/or are short-lived and are unlikely to be severely affected, while stable environments with long-lived species are more likely to experience long-term and significant changes to the benthic community (Johnson 2002, Kathleen A. Mirarchi Inc. and CR Environmental Inc. 2005, Stevenson et al. 2004). While there may be some changes to the benthic communities on which Atlantic sturgeon feed as a result of bottom trawling, there is no evidence the bottom trawl activities will have a negative impact on availability of Atlantic sturgeon prey; therefore, effects to Atlantic sturgeon are extremely unlikely to occur and thus discountable.

7.5.3 Assessment of Risk of Interactions with Ventless Trap Survey

As described in Section 3.0 *Description of Proposed Action*, ventless trap gear will be used in a BACI sampling design to evaluate changes in the distribution and abundance of Jonah crab, lobster, rock crab, and black sea bass in the SouthCoast Wind WFA and adjacent control areas. The BACI trap survey will be conducted with 30 6-trap trawls (multiple traps linked together by sinking groundline) in the SouthCoast Wind WFA and the three control areas that will be sampled twice per month (3-day soaks) to the degree possible from May through October over a 5 year period. Each trawl will be comprised of three ventless traps and three standard vented traps alternating in the string. The survey will sample 30 random depth-stratified stations distributed throughout the lease area and control area in a BACI design. Station locations will be reselected each year. The purpose of the sampling design is to assess whether lobsters, Jonah crabs, or black sea bass occur in higher abundance near the foundation locations relative to other locations within the SouthCoast Wind ventless trap survey impact area as well as predation rate of black sea bass on lobsters. During the operational phase of the project, fifteen foundation locations in the SouthCoast Wind WFA will be selected at random, and six trap trawls of ventless traps will be intentionally set with the mid-point of the trawl as close to the foundation as possible, along with fifteen traps placed in three control areas adjacent to the WFA. The survey will follow the same protocols and sampling season (May-October) as the BACI survey. All trap gear will follow all applicable regulations and will employ "ropeless" methodology, which will eliminate vertical lines and surface buoys except for when trap trawls will be hauled to the surface by the vessel conducting the survey. No wet storage of trap gear is proposed; as such, the gear will be removed from the water between monthly survey periods and at the end of the survey season. Neuston net sampling for zooplankton will be done in conjunction with ventless trap surveys at the 30 stations across the WDA and control areas; effects of this survey were addressed above.

ESA Listed Whales

Factors Affecting Interactions and Existing Information on Interactions

Any line in the water column, including line resting on or floating above, the seafloor set in areas where whales occur, theoretically has the potential to entangle a whale (Hamilton et al. 2019, Johnson et al. 2005). Entanglements may involve the head, flippers, or fluke; effects range from no apparent injury to death. Large whales are generally vulnerable to entanglement in vertical and groundlines associated with trap/pot gear.

The general scenario that leads to a whale becoming entangled in gear begins with a whale encountering gear. It may move along the line until it comes up against something such as a buoy or knot. When the animal feels the resistance of the gear, it is likely to thrash, which may cause it to become further entangled in the lines associated with gear. The buoy may become caught in the whale's baleen, against a pectoral fin, or on some other body part. Consistent with the best available information on gear configurations to reduce entanglement risk, all applicable gear modifications and amendments and risk reduction measures will be consistent with the requirements and regulations implementing the Atlantic Large Whale Take Reduction Plan (50

CFR Parts 229 and 697). As explained above, there will be no vertical lines attached to the trap survey gear; thus, there will be no vertical lines between the bottom and the surface. The only lines associated with the surveys will be the sinking groundlines resting on the bottom that are attaching traps together in a trawl. We note that neither the BA nor the survey plan describe any other vertical lines associated with the survey and any modification to include traditional vertical lines, either attached to the survey gear or adjacent or alongside it to "mark" the location is not considered here. Any such change to the proposed action would result in a modification to the proposed action in a manner that causes an effect to the listed species or critical habitat that was not considered in this biological opinion thus requiring reinitiation of this consultation.

Blue, Sei, and Sperm Whales
Blue, sei, and sperm whales typically occur in deep, offshore waters near or beyond the continental shelf break; this is well offshore of where the trap and pot surveys will take place. Records of observed sei and sperm whale entanglements are limited due to their offshore distribution, while this may reduce the potential for observations it also reduces the overlap between many fisheries and these species. From 2016-2020, in the western North Atlantic there was 1 mortality, 1 serious injury, and 1 non-serious injury from entanglement for sei whales and no documented interactions between fishing gear and blue or sperm whales (Henry et al. 2022). Although entanglements has been documented for sei whales, the fishing gear in these cases involved the use of buoys/vertical lines which pose a much higher risk to all whale species as the line is present in the entire water column. The use of ropeless gear with only sinking groundlines greatly reduces any risk to blue, sei, and sperm whales given the line is in contact with the seafloor. These species are also rare to the survey area and thus potential for co-occurrence is low.

In order for a blue, sei, or sperm whale to be vulnerable to entanglement in the trap survey gear, the whale would have to first co-occur in time and space with that gear, that is it would need to be in the same area that the traps are being fished and the whales would need to be moving along the seafloor and interact with the groundline with either their open mouth, flippers, or tail. During retrieval of each trap trawl, the survey vessel would be hauling gear and thus the groundline connecting to each trap would be in the water column at this point, however, this would only be for a short time (minutes) as the gear is being actively hauled. As the survey vessels will have a lookout for protected species, no gear would be retrieved or deployed if protected species are observed, thus further reducing any risk for interaction while the gear is being hauled. Given the rarity of blue, sei, and sperm whales in the survey area, the relatively small amount of gear (30 total trawls with 6 traps each periodically deployed between May-October each year) that will be utilized over the course of five years, and ropeless trap gear (with no vertical lines or buoys) that will be used and thus require a blue, sei, or sperm whale to physically interact with the groundline resting on the seafloor, it is extremely unlikely that a blue, sei, or sperm whale would encounter this gear; therefore, effects are discountable. Therefore, the deployment, use, and retrieval of ventless trap gear set for SouthCoast trawl surveys are not likely to adversely affect any blue, sei, or sperm whales.

Fin and North Atlantic Right Whales
Fin whales and North Atlantic right whales may occur year round in the area where the trap surveys will take place. Fin whales are most likely to occur in the area in the summer (June –

September). North Atlantic right whales are most likely to occur in the area from December through May, with the highest probability of occurrence extending from January through April. The trap survey, which will result in gear set intermittently from May through October, will occur at the time of year when the lowest numbers of right whales occur in the survey area.

The Environmental Impact Statement (EIS) prepared for the Atlantic Large Whale Take Reduction Plan (ALWTRP EIS, NMFS 2021b) determined that entanglement in commercial fisheries gear represents the highest proportion of all documented serious and non-serious incidents reported for fin whales and right whales. Entanglement risk primarily occurs with the vertical line of trap/pot gear, but groundlines also pose a risk as right whales have been shown to utilize the entire water column (Hamilton and Kraus 2019). Fin whales may also use the entire water column, however, they are not known to feed right above the seafloor given their feeding mechanism (lunge feeding) and prey (small schooling fish, krill) (Friedlaender et al. 2020). For a fin or right whale to interact with the groundline, it must also interact with the seafloor. In an analysis of the North Atlantic right whale photo-identification catalog, sightings of right whales with seafloor sediment on their bodies showed that between 1980 and 2016, there were 2,053 detections of right whales with 'mud' on their bodies. Although these sightings were throughout their range and in all months, 92.7% of all detections occurred in the Bay of Fundy in the summer (Hamilton and Kraus 2019). Right whale dive behavior demonstrates that whales may be feeding just above the seafloor at times (Baumgartner et al. 2017). There are no records of fin whale entanglements in groundlines. Entanglement in the groundline of trap/pot gear is rare for right whales, as it requires the animal to maneuver themselves under the groundline and then wrap themselves. The use of sinking groundline makes this even less likely to occur.

In order for a fin or right whale to be vulnerable to entanglement in the trap survey gear, the whale would have to first co-occur in time and space with that gear, that is it would need to be in the same area that the traps are being fished and the whales would need to be moving along the seafloor and interact with the groundline with either their open mouth, flippers, or tail in a way that resulted in entanglement. Fin whales are common throughout the southern New England region during the time of year the trap surveys will be conducted, however, fin whales are not known to interact with the seafloor when they feed, and there have not been any interactions of fin whale entanglements in groundlines. During the time of year when the trap surveys will be conducted (May-October), right whales are at their lowest density in the areas where the trap surveys will be conducted. Thus, we expect few instances of overlap in space/time between right whales and the survey gear. Additionally, as established above, entanglement would require an individual to move at least part of its body underneath the sinking groundline and become wrapped.

During retrieval of each trap trawl, the survey vessel would be hauling gear and thus the groundline connecting to each trap would be in the water column at this point, however, this would only be for a short internment time as the gear is being actively hauled. As the survey vessels will have a lookout for protected species, no gear would be retrieved or deployed if protected species are observed, thus further reducing any risk for interaction while the gear is being hauled.

Given the small amount of gear (30 total trawls with 6 traps per trawl periodically deployed between May-October each year) that will be deployed over the course of five years, the ropeless trap (with no vertical lines or buoys or weak link trap gear) that will be used and thus require a fin or right whale to physically interact with the groundline resting on the seafloor, the fact that no fin whale entanglements in groundlines have been reported, and the time of year when surveys will occur is when right whale occurrence is lowest in the survey area, it is extremely unlikely that a fin or right whale would encounter this gear and effects are discountable. Therefore, the deployment, use, and retrieval of ventless trap gear set for SouthCoast trawl surveys are not likely to adversely affect any right or fin whales.

Effects to Prey
The proposed trap survey activities will not have any effects on the availability of prey for blue, right, fin, sei, and sperm whales. Right whales and sei whales feed on copepods (Perry et al. 1999). Copepods are very small organisms that will pass through trap/pot gear rather than being captured in it. Similarly, fin whales feed on krill and small schooling fish (e.g., sand lance, herring, mackerel) (Aguilar 2002). The size of the trap/pot gear is too large to capture any fish that may be prey for listed whales. Sperm whales feed on deep water species that do not overlap with the study area where trap and pot activities will occur.

Sea Turtles

Factors Affecting Interactions and Existing Information on Interactions
Available entanglement data for sea turtles indicate they may be vulnerable to entanglement in trap/pot gear, primarily the vertical lines; however, the trap gear used for the SouthCoast Wind survey will not use vertical lines. Thus, the only entanglement risk to sea turtles is the sinking groundline. Sea turtles in the survey area are too big to be caught in the traps themselves since the vents/openings leading inside are far smaller (5 inches) than any of the life stages (sub-adult, adult) of the species that are expected to occur in southern New England waters. Given data documented in the GAR STDN database, leatherback sea turtles seem to be the most vulnerable turtle to entanglement in vertical lines of fixed fishing gear in the action area. Long pectoral flippers may make leatherback sea turtles more vulnerable to entanglement. In 2007, a leatherback sea turtle was entangled in the lines connecting whelk pots (GAR STDN, unpublished data).

Leatherbacks entangled in fixed gear are often observed with the vertical buoy line wrapped tightly around the flippers multiple times suggesting entangled leatherbacks are typically unable to free themselves from the gear (Hamelin et al. 2017). Leatherback entanglements in trap/pot gear may be more prevalent at certain times of the year when they are feeding on jellyfish in nearshore waters (i.e., Cape Cod Bay) where trap/pot fishing gear is concentrated. Hard-shelled turtles also entangle in vertical lines of trap/pot gear. Due to leatherback sea turtles large size, they likely have the strength to wrap fixed fishing gear lines around themselves, whereas small turtles such as Kemp's ridley or smaller juvenile hard-shelled turtles likely do not. However, entanglement in the groundline of trap/pot gear is rare as it requires the animal to maneuver themselves under the groundline and then wrap themselves.

Records of stranded or entangled sea turtles show entanglement of trap/pot lines around the neck, flipper, or body of the sea turtle; these entanglements can severely restrict swimming or feeding

(Balazs 1985). Constriction of a sea turtle's neck or flippers can lead to severe injury or mortality. While drowning is the most serious consequence of entanglement, constriction of a sea turtle's flippers can amputate limbs, also leading to death by infection or to impaired foraging or swimming ability. If the turtle escapes or is released from the gear with line attached, the flipper may eventually become occluded, infected, and necrotic. Entangled sea turtles can also be more vulnerable to collision with boats, particularly if the entanglement occurs at or near the surface (Lutcavage et al. 1997).

Estimating Interactions with Sea Turtles
Small turtles such as Kemp's ridley or smaller juvenile hard-shelled turtles likely do not have the strength to maneuver themselves under the groundline and then wrap themselves in it. Due to the size of Kemp's ridley and green sea turtles in the areas where the trap survey will be conducted, interactions with these species in the groundlines of the trap gear are extremely unlikely to occur and effects from entanglement are therefore discountable.

Larger turtles such as loggerhead turtles or leatherback turtles may forage along the seafloor and have the strength to maneuver themselves under the groundline and then wrap themselves in it, however, given the groundline is in contact with the seafloor it is unlikely sea turtles would come in contact with it. This risk is further reduced by the small amount of gear that will be set (30 6-trap trawls) and the short duration that it will be present (3-day soak time). During retrieval of each trap trawl, the survey vessel would be hauling gear and thus the groundline connecting to each trap would be in the water column at this point, however, this would only be for a short internment time as the gear is being actively hauled. As the survey vessels will have a lookout for protected species, no gear would be retrieved or deployed if protected species are observed, thus further reducing any risk for interaction while the gear is being hauled. Based on this information, it is extremely unlikely that loggerhead or leatherback turtles will be captured or entangled in the trap gear deployed as part of the proposed surveys. Therefore, effects are discountable for all ESA-listed sea turtles, and the deployment, use, and retrieval of ventless trap gear set for SouthCoast trawl surveys are not likely to adversely affect any ESA-listed sea turtles.

Effects to Prey
Sea turtle prey items such as horseshoe crabs, other crabs, whelks, and fish may be removed from the marine environment as bycatch in trap/pot gear. None of these are typical prey species of leatherback sea turtles or of neritic juvenile or adult green sea turtles. Therefore, the SouthCoast trap survey will not affect the availability of prey for leatherback and green sea turtles in the action area. Neritic juveniles and adults of both loggerhead and Kemp's ridley sea turtles are known to feed on the species that may be caught as bycatch in the trap/pot gear. However, all bycatch is expected to be returned to the water alive, dead, or injured to the extent that the organisms will shortly die. Injured or deceased bycatch would still be available as prey for sea turtles, particularly loggerheads, which are known to eat a variety of live prey as well as scavenge dead organisms. Given this information, any effects on sea turtles from collection of potential sea turtle prey in the trap/pot gear will be so small that they cannot be meaningfully measured, detected, or evaluated and, therefore, effects are insignificant.

Atlantic Sturgeon

Factors Affecting Interactions and Existing Information on Interactions
Entanglement or capture of Atlantic sturgeon in trap gear is extremely unlikely. To become captured or entangled in the trap gear, sturgeon would either need to enter the trap or become wrapped in the sinking groundline between each trap. A review of all available information resulted in several reported captures of Atlantic sturgeon in trap/pot gear in Chesapeake Bay as part of a reward program for reporting Atlantic sturgeon in Maryland, yet all appeared to be juveniles no greater than two feet in length. Juvenile Atlantic sturgeon do not occur in the area where the SouthCoast Wind surveys will take place. In addition, there has been one observed interaction, in 2006, on a trip where the top landed species was blue crab (NEFSC observer/sea sampling database, unpublished data). No incidents of trap/pot gear captures or entanglements of sturgeon have been reported in ten federal fisheries ((1) American lobster, (2) Atlantic bluefish, (3) Atlantic deep-sea red crab, (4) mackerel/squid/butterfish, (5) monkfish, (6) Northeast multispecies, (7) Northeast skate complex, (8) spiny dogfish, (9) summer flounder/scup/black sea bass, and (10) Jonah crab fisheries). The proposed surveys conducted by SouthCoast Wind are aimed to replicate a number of these fisheries to assess the impact of offshore wind development in the WDA. The traps used in the survey are 16 inches high, 40 inches long, and 21 inches wide with 5-inch entrance hoops and constructed with 1-inch square rubber coated 12-gauge wire, given these dimensions, an adult sturgeon would not be able to enter the 5-inch entrance hoop and thus capture is extremely unlikely to occur. Although Atlantic sturgeon may feed along the seafloor in the SouthCoast Wind WDA, we do not expect them to move beneath the sinking groundline and then wrap themselves in the groundline and become entangled. Based on this information, it is extremely unlikely that Atlantic sturgeon from any DPS will be captured or entangled in the trap gear deployed as part of the proposed surveys. Therefore, effects are discountable. Therefore, the deployment, use, and retrieval of ventless trap gear set for SouthCoast trawl surveys are not likely to adversely affect any Atlantic sturgeon.

Effects to Prey
The trap and pot gear that will be used to assess lobster and crab species and structure-associated fish species are considered to have low impact to bottom habitat, and is unlikely to incidentally capture Atlantic sturgeon invertebrate prey. Given this information, it is extremely unlikely the trap/pot activities conducted by SouthCoast Wind will have any effect on Atlantic sturgeon prey.

7.5.4 Impacts to Habitat
Here we consider any effects of the proposed marine resource survey and monitoring activities on habitat of listed species. The SPI/PV equipment, ventless traps, and drop cameras will be set on the ocean floor, which could result in disturbance of benthic resources. Acoustic receivers and moored PAM systems may include a lander or anchor that would rest on the seafloor. However, the size of the area that would be disturbed by setting this gear is extremely small and any effects to benthic resources would be limited to temporary disturbance of the bottom in the immediate area where the gear is set. Although ventless traps will rest on the seafloor, Carmichael et al. (2015) found that traps have little or low impact on bottom habitat. In an analysis of effects to habitat from fishing gears, mud and sand habitats were found to recover more quickly than courser substrates (see Appendix D in NEFMC 2016, NEFMC 2020). No effects to any ESA listed species are anticipated to result from this small, temporary, intermittent, disturbance of the bottom sediments.

An assessment of fishing gear impacts found that mud, sand, and cobble features are more susceptible to disturbance by trawl gear, while granule-pebble and scattered boulder features are less susceptible (see Appendix D in NEFMC 2016, NEFMC 2020). Geological structures generally recovered more quickly from trawling on mud and sand substrates than on cobble and boulder substrates; while biological structures (i.e. sponges, corals, hydroids) recovered at similar rates across substrates. Susceptibility was defined as the percentage of habitat features encountered by the gear during a hypothetical single pass event that had their functional value reduced, and recovery was defined as the time required for the functional value to be restored (see Appendix D in NEFMC 2016, NEFMC 2020). The otter trawl and drop cameras may also interact with the ocean floor and may affect bottom habitat in the areas surveyed. However, given the infrequent survey effort, the limited duration of the surveys, and the very small footprint, any effects to ESA listed species resulting from these minor effects to benthic habitat will be so small that they cannot be meaningfully measured, evaluated, or detected.

7.6 Consideration of Potential Shifts or Displacement of Fishing Activity

As described in Section 7.2 (*Effects of Project Vessels*) the lease area and the area along the cable corridors support commercial and recreational fishing activity throughout the year. Fishing activity includes a variety of fixed gear (e.g. gillnets, pot/traps) and mobile gear fisheries (e.g. trawl (bottom and mid-water), dredge (clam and scallop) and hook and line. Fisheries include: American lobster, Atlantic herring, Atlantic sea scallops, Atlantic surfclam, bluefish, Jonah crab, hakes, squid, butterfish, channeled whelk, summer flounder, scup, black sea bass, Atlantic mackerel, skates, striped bass, tautog, weakfish, winter flounder, bonito, cunner, spot, conger eel, sea robbins, and spiny dogfish (SouthCoast Wind COP Appendix V., 2021). Fishing effort is highly variable due to factors including target species distribution and abundance, environmental conditions, fishing regulations, season, and market value. Within the SouthCoast Wind lease area, the bottom trawl, lobster pots, and gillnets targeting multiple species, was the primary commercial fishing gear utilized in terms of value and landings. Of the species for which data can be shared due to requirements to protect confidentiality, the most landed commercial fishery in pounds was the longfin squid, which was also the most economically valuable species within the SouthCoast Wind Lease Area (SouthCoast Wind COP Appendix V., 2021). Table 2-5 in the SouthCoast COP Appendix V offers details into the commonly caught species in the offshore project area from 2008-2018. As addressed in Section 5.0 *Status of the Species* and Section 6.0 (*Environmental Baseline*) of this Opinion, interactions between fishing gear (e.g., bycatch, entanglement) and listed whales, sea turtles, and Atlantic sturgeon occur throughout their range and may occur in the action area.

Here, we consider how the potential shift or displacement of fishing activity from the lease area and cable corridors, because of the proposed project, may affect ESA listed whales, sea turtles, and Atlantic sturgeon. As described in Section 5.10.1 of the SouthCoast BA, potential impacts to fishing activities in the lease area and along the cable corridors during the construction phase of the proposed project are primarily related to accessibility. During the construction and decommissioning phases, potential effects to fishing operations include displacement of vessel transit routes and shifts in fishing effort due to disruption in access to fishing grounds in the areas where construction activities will occur due to the presence of Project vessels and construction activities. Impacts to fishing operations during the operational phase may result from habitat conversion, safety concerns operating around structures, and other factors that may affect access (increased user conflicts, increased insurance rates, etc.).

While changes in distribution and abundance of species targeted by commercial fisheries could occur during construction due to exposure to increased sediment, noise, and vibration, these effects are anticipated to be short-term and localized and not result in any changes in abundance or distribution of target species that would be great enough to result in changes in patterns of fishing activity. To the extent that construction has negative effects on the reproductive success of commercial fish species (e.g., Atlantic cod, longfin squid), there is the potential for a decrease in fish abundance and future consequences on fishing activity. Impacts during the decommissioning phase of the Project are expected to be similar. Displacement of fishing vessels and shifts in operations during the construction and decommissioning phases that are related to a shift or change in target species distribution and abundance are expected.

During the operational phase of the project, the potential impacts to fishing activity are primarily anticipated from potential accessibility issues due to the presence and spacing of WTGs and the OSPs as well as potential avoidance of the inter-array and export cable routes due to concerns related to avoiding the potential for snags or other interactions with the cable or cable protection. Additionally, there may be localized impacts on the abundance and distribution of some target species due to changes in habitat conditions (e.g., foundations and scour protection, noise and vibration associated with turbine operations, consequences of reef effect resulting in changes in localized species composition). While there are no restrictions proposed for fishing activity in the WDA, the presence and spacing of structures (approximately 1x1 nautical miles) may impede fishing operations for certain gear types. Additionally, as explained in Section 7.4 *Effects to Habitat and Environmental Conditions During Operations*, the structures will provide new hard bottom habitat in the WDA creating a “reef effect” that may attract fish and, as a result, fishermen, particularly recreational anglers and party/charter vessels. This could create vessel congestion and could dissuade commercial vessels from fishing among the structures.

The potential for shifts in fishing effort due to the proposed project is expected to vary by gear type and vessel size. Of the gear types that fish within the lease area and cable corridors, bottom tending mobile gear is more likely to be displaced than fixed gear, with larger fishing vessels using dredges and trawl gear, including mid-water trawl gear, more likely to be displaced compared to smaller fishing vessels using similar gear types that may be easier to maneuver. However, even without any area use restrictions, there may be different risk tolerances among vessel captains that could lead to at least a temporary reduction in fishing effort in the lease area and along the cable corridors during construction and decommissioning activities, and longer-term reduction of fishing effort during the operational phase of the project. Space use conflicts due to displacement of commercial fishing activity from the lease area to surrounding waters could cause a temporary or permanent reduction in such fishing activities within the lease area and an increase in fishing activities elsewhere. Additionally, there could be increased potential for gear conflicts within the lease area as commercial fisheries and for-hire and private recreational fishing compete for space between turbines, especially if there is an increase in recreational fishing for structure-affiliated species attracted to the foundations (e.g., black sea bass). Fixed gear fisheries, such as the monkfish fishery, may resume or even increase fishing activity in the lease area and along the cable corridors shortly after construction because these fisheries are relatively static (i.e.,. relatively stationery in location), though there may be small shifts in gear placement to avoid areas very close to project infrastructure. Mobile fisheries, such as Atlantic herring and sea scallop fisheries may take longer to resume fishing activity within the lease area or along the cable corridors as the physical presence of the new Project infrastructure may alter the habitat, behavior of fishing vessels, and target species. However, for all fisheries, any changes in fishing location are expected to be limited to moves to nearby, geographically adjacent areas, particularly on the fringes of the lease area, given the distribution of target species and distance from home ports, all of which limit the potential for significant geographic shifts in distribution of fishing effort. For example, if fishing effort were to shift for longfin squid, effort may shift northeast or southwest outside of the WDA to other areas of similar squid availability south of Martha's Vineyard/Nantucket and Long Island.

Fishing vessel activity (transit and active fishing) is high throughout the southern New England region and Mid-Atlantic Bight as a whole, with higher levels of effort occurring outside of the WDA than within the WDA. The scale of the proposed Project (up to 149 WTG/OSP positions (up to 5 OSPs) and the footprint of the lease area (127, 388 acres) relative to the size of available fishing area are small. Fishing activity will not be legally restricted within the lease area and the proposed spacing of the turbines could allow for fishing activity to occur, depending on the risk tolerance of the operator and weather conditions. Any reduction in fishing effort in the lease area would reduce the potential for interactions between listed species and fishing gear in the lease area, yet any beneficial effect would be expected to be so small that it cannot be meaningfully measured, evaluated, or detected. Similarly, any effects to listed species from shifts of fishing effort to areas outside of the WDA are also expected to be so small that they cannot be meaningfully measured, evaluated, or detected. This is because any potential shifts are expected to be limited to small changes in geographic area and any difference in the risk of interaction between fishing gear and listed species is expected to be so small that it cannot be meaningfully measured, detected, or evaluated.

As explained in Section 7.4 *Effects to Habitat and Environmental Conditions During Operations* above, the presence of new structures (e.g., WTGs and OSP foundations) may also act as artificial reefs and could theoretically attract a range of species, including listed species such as sea turtles and sturgeon if the foundations serve to aggregate their prey. As explained in Section 7.4 *Effects to Habitat and Environmental Conditions During Operations*, any changes in biomass around the foundations are expected to be so small and localized that they would have insignificant effects on the distribution, abundance, and use of the lease area by listed sea turtles or Atlantic sturgeon. We do not expect that any reef effect would result in any increase in species preyed on by North Atlantic right, fin or sei whales and note that sperm and blue whales are generally not expected to forage in the shallow waters of the lease area. As noted previously, we do not expect any effects on the distribution, abundance, or use of the lease area by ESA listed whales that would be attributable to the physical presence of the foundations.

This potential increase in biomass around the new structures of the SouthCoast Wind Farm may result in an increase in recreational anglers targeting structure affiliated fish species and subsequently may increase incidental interactions between recreational anglers and listed species. At the Block Island Wind Farm (Rhode Island), and other offshore wind farms in

Europe, recreational fishermen have expressed a generally positive sentiment about the wind farm as an enhanced fishing location due to the structures as there are no other offshore structures or artificial reefs in surrounding waters (Hooper, Hattam & Austern 2017, ten Brink & Dalton 2018, Smythe, Bidwell & Tyler 2021). Interactions between listed species, particularly sea turtles, and recreational fishing do occur, especially in areas where target species and listed species co-occur (Rudloe & Rudloe 2005, Seney 2016, Swingle et al. 2017, Cook, Dunch & Coleman 2020). Listed sea turtles may be attracted to the structures of the foundations to forage and seek refuge and also may be attracted to bait used by anglers, depending on species.

Whales colliding/hitting vessels, primarily recreational vessels engaged in fishing activities is uncommon to begin with, but can happen[53], primarily when prey of whales and species targeted by fishermen co-occur. As mentioned in Section 7.4.3.1 (*Consideration of the Physical Presence of Structures on Movements of Listed Species),* it is expected whales will be able to transit the lease area freely given the spacing between turbine foundations and as explained in Section 7.4.3.2 (*Habitat Conversion and Reef Effect Due to the Presence of Physical Structures),* turbine foundations are not expected to cause an increase in prey that would then result in greater co-occurrence of prey, target species, whales, and vessels and thus risk of whales colliding with vessels engaged in fishing. We expect the risk posed to protected species from any shifts and/or displacement of recreational fishing effort caused by the action to be so small that they cannot be meaningfully measured, evaluated, or detected and are therefore, insignificant. For the same reasons, we do not expect any increased vessel strike risk from fishing vessels and Atlantic sturgeon or sea turtles.

In summary, we expect the risks of entanglement, bycatch, or incidental hooking interactions due to any shifts or displacement of recreational or commercial fishing activity caused by the proposed Project to be so small that they cannot be meaningfully measured, evaluated, or detected.

7.7 Repair and Maintenance Activities

SouthCoast Wind would design WTGs and OSPs to operate by remote control, so personnel would not be required to be present except to inspect equipment and conduct repairs. Effects of vessel traffic associated with repairs and maintenance during the operations phase is considered in Section 7.2 *Effects of Project Vessels* above. Effects of noise associated with project vessels and aircraft are addressed in the Section 7.1 *Underwater Noise* above; these effects were determined to be insignificant.

Project components would be inspected regularly; these visual inspections would have no effects on listed species. Bathymetric and other surveys would be undertaken to monitor cable exposure and/or depth of burial; the effects of acoustic surveys of the cable corridor were considered in the acoustics analysis; no other effects are anticipated. Minor underwater work, associated with minor repairs of the metalwork of the foundations may involve welding by divers; no effects to listed species are anticipated from these activities. Periodic cleaning of the foundations will involve using a brush to break down the marine growth (where required) followed by high-

[53] https://boston.cbslocal.com/2021/07/13/block-island-whale-boat-rescue/

pressure jet wash (seawater only). More significant repairs would be necessary if there was a major component failure (i.e., gearbox, blades, transformer). However, no in-water work is anticipated (other than vessels) to carry out these repairs; therefore, we do not anticipate any effects to listed species.

BOEM has indicated that given the burial depth of the inter-array cable and the SouthCoast Wind export cable, displacement, or damage by vessel anchors or fishing gear is unlikely. In the event that cable repair was necessary due to such an event or some other unexpected maintenance issue, it could be necessary to remove a portion of the cable and splice in a new section. We determined that acoustic and habitat based effects of cable installation would be insignificant or extremely unlikely to occur; as any cable repair will essentially follow the same process as cable installation except in only a small portion of the cable route and for a shorter period of time, we expect that the effects will be the same or less and therefore would also be insignificant.

Based on our review of the planned repair and maintenance activities described in the BA, DEIS and COP), no additional effects beyond those considered in the previous sections of this Opinion are anticipated to result from repair and maintenance activities over the life of the project.

7.8 Unexpected/Unanticipated Events

In this section, we consider the "unexpected/unanticipated events" that were identified by BOEM in the BA (Section 5.10.2). These events, while not part of the proposed action, include collisions between vessels, allisions (defined as a strike of a moving vessel against a stationary object) between vessels and WTGs or OSPs, accidental spills, and severe weather events resulting in equipment failure.

In July 2024, during the commissioning of one of WTGs installed for the Vineyard Wind 1 Offshore Project, a single turbine blade broke. This resulted in the release of a portion of the blade into the ocean. At the time this Opinion was being written, emergency response activities, including clean up of blade debris was ongoing. Results from the root cause analysis, including BSEE's independent evaluation of the causes of the failure, are not yet available. BSEE has ordered thorough inspections of all Vineyard Wind blades; as such, at this time, we expect that the cause of the blade failure will be identified and that any blades that may exist that have characteristics that would make them vulnerable to the same failure (e.g., a manufacturing defect as is currently suspected by GE, the blade manufacturer) will be identified and removed from deployment at any future offshore wind project. At this time, we do not know what vendor SouthCoast will procure turbine blades from and we have no information to indicate that a similar blade failure at any of the SouthCoast WTGs would be likely to occur. Through the ongoing evaluation of the July 2024 Vineyard Wind event or other means, should information become available that indicates that there would be effects to listed species of project operations that were not evaluated in this Opinion, consultation would need to be reinitiated.

7.8.1 Vessel Collision/Allision with Foundation

A vessel striking a wind turbine theoretically could result in a spill or catastrophic failure/collapse of the turbine. However, there are several measures in place that ensure such an event is extremely unlikely to occur and not reasonably certain to occur. These include: inclusion of project components on nautical charts which would limit the likelihood of a vessel operator being unaware of the project components while navigating in the area; compliance with lighting and marking required by the USCG which is designed to allow for detection of the project components by vessels in the area; and, spacing of turbines to allow for safe navigation through the project area. Because of these measures, a vessel striking a project foundation is extremely unlikely to occur. The Navigational Risk Assessment (COP Appendix X) prepared for the project reaches similar conclusions and determined that it is highly unlikely that a vessel will strike a foundation and even in the unlikely event that such a strike did occur, the collapse of the foundation is highly unlikely even considering the largest/heaviest vessels that could transit the WDA. Therefore, based on this information, any effects to listed species that could theoretically result from a vessel collision/allision (e.g..., oil/chemical spill, being struck by a failing structure) are extremely unlikely to occur and thus are discountable.

7.8.2 Failure of WTGs due to Weather Event

As explained in the BA, SouthCoast Wind designed the proposed Project components to withstand severe weather events. The WTGs are equipped with safety devices to ensure safe operation during their lifetime. These safety devices may vary depending on the WTG selected and may include vibration protection, over speed protection, and aerodynamic and mechanical braking systems, as well as electrical protection devices. As described in the DEIS, the engineering specifications of the WTGs and their ability to sufficiently withstand weather events is independently evaluated by a certified verification agent when reviewing the Facility Design Report and Fabrication and Installation Report according to international standards, which include withstanding hurricane-level events. One of these standards calls for the structure to be able to withstand a 50-years return interval event. An additional standard includes withstanding 3-second gusts of a 500-years return interval event, which would correspond to Category 5 hurricane wind speeds. With these considerations, BOEM concludes that structural failure of a WTG (i.e., loss of a blade or tower collapse) is highly unlikely.

Few hurricanes pass through New England, but the area is subjected to frequent Nor'easters that form offshore between Georgia and New Jersey, and typically reach maximum intensity in New England. These storms are usually characterized by winds from the Northeast, heavy precipitation, wind, storm surges, and rough seas. Knutson et al. (2020) expresses medium-to-high confidence that global average intensity of tropical cyclones will increase between 1% and 10% and that the proportion of tropical cyclones reaching Category 4 or 5 strength will increase. Frequency of tropical cyclones overall is projected to decrease globally, with low-to-medium certainty expressed by the authors. Taken in context with the historical record of hurricanes affecting New England, Category 3 hurricanes may become more frequent than the historical 50 years, and the future probability of a Category 4 or 5 hurricane affecting New England will likely be higher than the historical probability of these events.

As described in the Navigational Risk Assessment (COP Appendix X), in winter, waves greater than 2.4 m occur about 10 to 15 percent of the time. The 10-year and 100-year return periods have significant wave heights of 9.4 and 10.3 m, respectively. Significant waves of up to 11.5 m (~38 ft.) have been measured at the Nantucket Shoals weather monitoring buoy (Station 44008) (available data from 1982 to 2008). The maximum significant wave height of 11.5 meters (37.73

ft.) was observed during the months of September in 1999, while the maximum wave period of 15.9 seconds occurred in February of 2004 (NDBC, 2017). Maximum wind gusts are also described in the NRA based on data collected from Station 44008 from 2007 to 2017. The maximum observed wind speed from 2007 to 2017 was 50.9 knots and occurred November 3-4, 2007 during extratropical storm Noel; Noel was observed to have wind speeds of 70 to 75 knots. As described in COP Appendix X, as measured at buoy 44008, wind speeds exceed 30 knots less than 1% of the time and 45 knots approximately 0.1% of the time.

In the DEIS, BOEM has indicated that the proposed WTGs will meet design criteria to withstand extreme weather conditions that may be faced in the future and include consideration of Category 5 hurricane windspeeds. Given that the project components are designed to endure wind and wave conditions that are far above the maximum wind and wave conditions recorded at the nearest weather monitoring buoy to the project, and exceed conditions which are expected to occur over the operational life of the project (i.e., incorporate a 500-year event), it is not reasonable to conclude that project components will experience a catastrophic failure due to a weather event over the next thirty years, even when considering a potential increase in hurricane activity in the area over this period. In other words, project components have been designed to withstand conditions that are not expected to occur more than once over the next 500years (e.g., exceeding 500-year 3 minute wind speed values and ocean forces). As a catastrophic failure would require conditions that are extremely unlikely to occur, any associated potential impacts to listed species are also extremely unlikely to occur and effects are discountable.

7.8.3 Oil Spill/Chemical Release

Several measures will be implemented to minimize the potential for any chemical or oil spills or accidental releases. SouthCoast Wind is required to comply with USCG and Bureau of Safety and Environmental Enforcement regulations relating to prevention and control of oil spills and will adhere to the Oil Spill Response Plan included in COP Appendix A-A. SouthCoast Wind would conduct refueling and lubrication of stationary equipment in a manner that is designed to minimize the risk of accidental spills. Additionally, a Construction Spill Prevention, Control, and Countermeasure Plan would be prepared in accordance with applicable requirements, and would outline spill prevention plans.

The toppling or collapse of a WTG or OSPs could theoretically result in a release of transformer oil, lubrication oil, and/or general oil. The OSPs would contain the greatest volumes of oils, with a maximum of approximately 150, 000 gallons of dielectric insulating oil, and 7,000 gallons of diesel fuel (COP, Appendix AA). The risk of a spill in the extremely unlikely event of a collapse is limited by the containment built into the structures. The WTGs and the OSPs are designed to be self-containing such that any leaks would be directed to collection areas within the WTG or OSP structure (SouthCoast Wind BA, 2024). The risk of a spill in the extremely unlikely event of a collapse is limited by the containment built into the structures. As such, catastrophic loss of any of the structures in a manner that would result in a spill is extremely unlikely to occur; therefore, the spill of oil from these structures is also extremely unlikely to occur.

Modeling presented by BOEM in the BA indicates the risk of spills associated with WTGs with a release of 128,000 gallons being likely to occur no more frequently than once every 1,000 years and a release of 2,000 gallons or less is likely to occur every 5 to 20 years (Bejarano et al., 2013;

SouthCoast Wind BA, 2024). However, this modeling assessment does not account for any of the spill prevention plans that will be in place for the project which are designed to reduce risk of accidental spills/releases. Considering the predicted frequency mentioned above, and the reduction in risk provided by adherence to USCG and BSEE requirements as well as adherence to the spill prevention plan both of which are designed to eliminate the risk of a spill of any substance to the marine environment, we have determined that any fuel or WTG or OSP fluid spill is extremely unlikely to occur; as such, any exposure of listed species to any such spill is also extremely unlikely to occur and thus, discountable.

We also note that in the unlikely event that there was a spill, if a response was required by the US EPA or the USCG, there would be an opportunity for NMFS to conduct a consultation with the lead Federal agency on the oil spill response which would allow NMFS to consider the effects of any oil spill response on listed species in the action area.

7.8.4 Failure of WTGs due to Seismic Activity

The Project is not within an active plate boundary area associated with an elevated seismic hazard; however, earthquakes can occur in intra-plate areas. Data compiled by the Northeast States Emergency Consortium (NESEC) reports that 408 earthquakes strong enough to be felt were reported in Massachusetts over a 348 year period. Of these, only two were considered "Damaging Earthquakes," a magnitude 5.6 in 1727 and a magnitude 6.2 in 1755. In Rhode Island there have only been 34 earthquakes reported between 1766 and 2016, none of which were considered "Damaging Earthquakes" (NESEC 2019). The closest cluster of micro-seismicity is associated with the Ramapo Fault Zone. Running southwest to northeast, it spans the northern portion of the state and has approximate endings near Schaefferstown, PA and Haverstraw, NY. The distance between the project area and local fault lines is such that events such as fault rupture, where fault movements are significant enough to breach the surface (which only occurs in a portion of earthquakes) are unlikely to occur in the lease area; therefore, effects to listed species that would be caused by a WTG's structural or equipment failure are extremely unlikely to occur and therefore, discountable. While seismic activity is not noted in the BA, this conclusion is consistent with the assessment of seismic risk presented in the DEIS.

7.9 Project Decommissioning

As described in the BA under 30 CFR Part 285 SouthCoast Wind would be required to remove or decommission all installations and clear the seabed of all obstructions created by the proposed Project within 2 years of the termination of its lease. All facilities would need to be removed 15 ft. (4.6 m) below the mudline (30 CFR § 585.910(a)). The portion buried below 15 ft. (4.6 m) would remain, and the depression refilled with the temporarily removed sediment. BOEM expects that WTGs and the OSPs would be disassembled and the piles cut below the mudline. SouthCoast Wind would clear the area after all components have been decommissioned to ensure that no unauthorized debris remains on the seabed. A cable-laying vessel would be used to remove as much of the inter-array and SouthCoast Wind Export Cable transmission cables from the seabed as practicable to recover and recycle valuable metals. Cable segments that cannot be easily recovered would be left buried below the mudline.

Information on the proposed decommissioning is very limited and the information available to us in the BA, DEIS, and COP limits our ability to carry out a thorough assessment of effects on listed species. Here, we evaluate the information that is available on the decommissioning. We note that prior to decommissioning, SouthCoast Wind would be required to submit a decommissioning plan to BOEM. According to BOEM, this would be subject to an approval process that is independent of the proposed COP approval. BOEM indicates in the DEIS that the approval process will include an opportunity for public comment and consultation with municipal, state, and federal management agencies. SouthCoast Wind would need to obtain separate and subsequent approval from BOEM to retire any portion of the Proposed Action in place. Given that approval of the decommissioning plan will be a discretionary Federal action, albeit one related to the present action, we anticipate that a determination will be made based on the best available information at that time whether reinitiation of this consultation is necessary to consider effects of decommissioning that are different from those considered here.

As described in Section 3.1.2.9 of the BA, it is anticipated that the equipment and vessels used during decommissioning will likely be similar to those used during construction and installation. For offshore work, vessels would likely include cable laying vessels, crane barges, jack-up barges, larger support vessels, tugboats, crew transfer vessels, and possibly a vessel specifically built for erecting WTG and OSP structures. Effects of the vessel traffic anticipated for decommissioning are addressed in the vessel effects section of this Opinion. As described below, based on the information available at this time, we have determined that all other effects of decommissioning will be insignificant.

As described in the BA and COP, cable removal would largely be the reverse of cable installation. We determined that acoustic and habitat based effects of cable installation would be insignificant or extremely unlikely to occur; as the cable removal will essentially follow the same process as cable installation except in reverse, we expect that effects will be the same and therefore would also be insignificant or extremely unlikely to occur. WTGs and OSPs would be dismantled with as many parts as possible being recycled.

Sediments inside the pile could be suctioned out and temporarily stored on a barge to allow access for cutting. Because this sediment removal would occur within the hollow base of the monopile, no listed species would be exposed to effects of this operation. The foundation and transition piece assembly is expected to be cut below the seabed in accordance with the BOEM's removal standards (30 C.F.R. 250.913). The portion of the foundation below the cut will likely remain in place. Depending upon the available crane's capacity, the foundation/transition piece assembly above the cut may be further cut into several more manageable sections to facilitate handling. Then, the cut piece(s) would be lifted out of the water and placed on a barge for transport to an appropriate port area for recycling.

The steel foundations would likely be cut below the mudline using one or a combination of: underwater acetylene cutting torches, mechanical cutting, or a high pressure water jet.
BOEM did not provide any estimates of underwater noise associated with pile cutting, and we did not identify any reports of underwater noise monitoring of pile cutting with the proposed methods. Hinzmann et al. (2017) reports on acoustic monitoring of removal of a met-tower monopile associated with the Amrumbank West offshore wind project in the North Sea off the coast of Germany. Internal jet cutting (i.e., the cutter was deployed from inside the monopile)

was used to cut the monopile approximately 2.5 m below the mudline. The authors report that the highest sound levels were between 250 and 1,000 Hz. Frequent stopping and starting of the noise suggests that this is an intermittent, rather than continuous noise source. The authors state that values of 160 dB SELcum and 190 dB Peak were not exceeded during the jet cutting process. At a distance of 750 m from the pile, noise attenuated to 150.6 dB rms. For purposes of this consultation, and absent any other information to rely on, we assume that these results are predictive of the underwater noise that can be expected during pile removal during project decommissioning. As such, using these numbers, we would not expect any injury to any listed species because the expected noise levels are below the injury thresholds for whales, sea turtles, and Atlantic sturgeon. We also do not expect any exposure to noise that could result in behavioral disturbance of sea turtles or whales because the noise is below the levels that may result in behavioral disturbance.

Any Atlantic sturgeon within 750 m of the pile being cut would be exposed to underwater noise that is expected to elicit a behavioral response. Exposure to that noise could result in short-term behavioral or physiological responses (e.g., avoidance, stress). Exposure would be brief, just long enough to detect and swim away from the noise, and consequences limited to avoidance of the area within 750 m of the pile during. As such, effects to Atlantic sturgeon will be so small that they cannot be meaningfully measured, evaluated, or detected, and would be insignificant.

The sediments previously removed from the inner space of the pile would be returned to the depression left once the pile is removed. To minimize sediment disturbance and turbidity, a vacuum pump and diver or ROV-assisted hoses would likely be used. This, in combination with the removal of the stones used for scour protection and any concrete mattresses used along the cable route, would reverse the conversion of soft bottom habitat to hard bottom habitat that would occur as a result of project construction. Removal of the foundations would remove the potential for reef effects in the lease area. As we determined that effects of habitat conversion due to construction would be insignificant, we expect the reverse to also be true and would expect that effects of habitat conversion back to pre-construction conditions would also be insignificant.

7.10 Consideration of the Effects of the Action in the Context of Predicted Climate Change due to Past, Present, and Future Activities

Climate change is relevant to the *Status of the Species*, *Environmental Baseline*, *Effects of the Action*, and *Cumulative Effects* sections of this Opinion. In the Section 5.0 *Status of the Species*, climate change as it relates to the status of particular species is addressed. Rather than include partial discussion in several sections of this Opinion, we are synthesizing our consideration of the effects of the proposed action in the context of anticipated climate change here.

In general, waters in the project area are warming and are expected to continue to warm over the 25-to-30-year life of the SouthCoast Wind project. However, waters in the North Atlantic Ocean have warmed more slowly than the global average or slightly cooled. This is because of the Gulf Stream's role in the Atlantic Meridional Overturning Circulation (AMOC). Warm water in the Gulf Stream cools, becomes dense, and sinks, eventually becoming cold, deep waters that travel back equatorward, spilling over features on the ocean floor and mixing with other deep Atlantic waters to form a southward current approximately 1500 m beneath the Gulf Stream (IPCC 2021). Globally averaged surface ocean temperatures are projected to increase by approximately 0.7 °C by 2030 and 1.4 °C by 2060 compared to the 1986-2005 average (IPCC 2014), with increases of closer to 2°C predicted for the geographic area that includes the action area. Data from the NOAA weather buoy closest to the lease area (44097) collected from 1984-2008 indicate a mean temperature range from a low of 5°C in the winter to a high of 24°C in the summer, and boat based surveys in the Lease Area had a minimum temperature of 2°C in the winter and a maximum of 26°C in the summer. Based on current predictions (IPCC 2014[54]), this could shift to a range of 7.9°C in the winter to 23.8°C in the summer. Ocean acidification is also expected to increase over the life of the project (Hare et al. 2016) which may affect the prey of a number of ESA listed species. Ocean acidification is contributing to reduced growth or the decline of zooplankton and other invertebrates that have calcareous shells (Pacific Marine Environmental Laboratory [PMEL] 2020).

We have considered whether it is reasonable to expect ESA listed species whose northern distribution does not currently overlap with the action area to occur in the action area over the project life due to a northward shift in distribution. We have determined that it is not reasonable to expect this to occur. This is largely because water temperature is only one factor that influences species distribution. Even with warming waters we do not expect hawksbill sea turtles to occur in the action area because there will still not be any sponge beds or coral reefs that hawksbills depend on and are key to their distribution (NMFS and USFWS 2013). We also do not expect giant manta ray or oceanic whitetip shark to occur in the lease area. Oceanic whitetip shark are a deep-water species (typically greater than 184 m) that occurs beyond the shelf edge on the high seas (Young et al. 2018). Giant manta ray also occur in deeper, offshore waters and occurrence in shallower nearshore waters is coincident with the presence of coral reefs that they rely on for important life history functions (Miller et al. 2016). Smalltooth sawfish do not occur north of Florida. Their life history depends on shallow estuarine habitats fringed with vegetation, usually red mangroves (Norton et al. 2012); such habitat does not occur in the lease area and would not occur even with ocean warming over the course of the proposed action. As such, regardless of the extent of ocean warming that may be reasonably expected in the action area over the life of the project, the habitat will remain inconsistent with habitats used by ESA listed species that currently occur south of the lease area. Therefore, we do not anticipate that any of these species will occur in the lease area over the life of the proposed action.

We have also considered whether climate change will result in changes in the use of the action area by Atlantic sturgeon or the ESA listed turtles and whales considered in this consultation. In a climate vulnerability analysis, Hare et al. (2016) concluded that Atlantic sturgeon are relatively invulnerable to distribution shifts. Given the extensive range of the species along nearly the entire U.S. Atlantic Coast and into Canada, it is unlikely that Atlantic sturgeon would shift out of the action area over the life of the project. If there were shifts in the abundance or distribution of sturgeon prey, it is possible that use of lease area by foraging sturgeon could become more or

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[54] IPCC 2014 is used as a reference here consistent with NMFS 2016 Revised Guidance for Treatment of Climate Change in NMFS Endangered Species Act Decisions (Available at: *https://www.fisheries.noaa.gov/national/endangered-species-conservation/endangered-species-act-guidance-policies-and-regulations*, last accessed March 2, 2023).

less common. However, even if the frequency and abundance of use of the lease area by Atlantic sturgeon increased over time, we would not expect any different effects to Atlantic sturgeon than those considered based on the current distribution and abundance of Atlantic sturgeon in the action area.

Use of the action area by sea turtles is driven at least in part by sea surface temperature, with sea turtles absent from the lease area and cable corridors from the late fall through mid-spring due to colder water temperatures. An increase in water temperature could result in an expansion of the time of year that sea turtles are present in the action area and could increase the frequency and abundance of sea turtles in the action area. However, even with a 2°C increase in water temperatures, winter and early spring mean sea surface temperatures in the lease area are still too cold to support sea turtles. Therefore, any expansion in annual temporal distribution in the action area is expected to be small and on the order of days or potentially weeks, but not months. Any changes in distribution of prey would also be expected to affect distribution and abundance of sea turtles and that could be a negative or positive change. It has been speculated that the nesting range of some sea turtle species may shift northward as water temperatures warm. Currently, nesting in the mid-Atlantic is extremely rare. In order for nesting to be successful, fall and winter temperatures need to be warm enough to support the successful rearing of eggs and sea temperatures must be warm enough for hatchlings to survive when they enter the water. Predicted increases in water temperatures over the life of the project are not great enough to allow successful rearing of sea turtle hatchlings in the action area. Therefore, we do not expect that over the time-period considered here, that there would be any nesting activity or hatchlings in the action area. Based on the available information, we expect that any increase in the frequency and abundance of use of the lease area by sea turtles due to increases in mean sea surface temperature would be small. Regardless of this, we would not expect any different effects to sea turtles than those considered based on the current distribution and abundance of sea turtles in the action area. Further, given that any increase in frequency or abundance of sea turtles in the action area is expected to be small we do not expect there to be an increase in risk of vessel strike above what has been considered based on current known distribution and abundance.

The distribution, abundance and migration of baleen whales reflects the distribution, abundance and movements of dense prey patches (e.g., copepods, euphausiids or krill, amphipods, shrimp), which have in turn been linked to oceanographic features affected by climate change (Learmonth et al. 2006). Changes in plankton distribution, abundance, and composition are closely related to ocean climate, including temperature. Changes in conditions may directly alter where foraging occurs by disrupting conditions in areas typically used by species and can result in shifts to areas not traditionally used that have lower quality or lower abundance of prey.

Climate change is unlikely to affect the frequency or abundance of sperm or blue whales in the action area. The species rarity in the lease area is expected to continue over the life of the project due to the depths in the area being shallower than the open ocean deep-water areas typically frequented by sperm whales and their prey. Two of the significant potential prey species for fin whales in the lease area are sand lance and Atlantic herring. Hare et al. (2016) concluded that climate change is likely to negatively impact sand lance and Atlantic herring but noted that there was a high degree of uncertainty in this conclusion. The authors noted that higher temperatures may decrease productivity and limit habitat availability. A reduction in small schooling fish such as sand lance and Atlantic herring in the lease area could result in a decrease in the use of the area by foraging fin whales. The distribution of copepods in the North Atlantic, including in the lease area, is driven by a number of factors that may be impacted by climate change. Record et al. (2019) suggests that recent changes in the distribution of North Atlantic right whales are related to recent rapid changes in climate and prey and notes that while right whales may be able to shift their distribution in response to changing oceanic conditions, the ability to forage successfully in those new habitats is also critically important. Warming in the deep waters of the Gulf of Maine is negatively impacting the abundance of *Calanus finmarchicus*, a primary prey for right whales. *C. finmarchicus* is vulnerable to the effects of global warming, particularly on the Northeast U.S. Shelf, which is in the southern portion of its range (Grieve et al. 2017). Grieve et al. (2017) used models to project *C. finmarchicus* densities into the future under different climate scenarios considering predicted changes in water temperature and salinity. Based on their results, by the 2041–2060 period, 22 – 25% decreases in *C. finmarchicus* density are predicted across all regions of the Northeast U.S. shelf. A decrease in abundance of right whale prey in the WDA could be expected to result in a similar decrease in abundance of right whales in the WDA over the same time scale; however, whether the predicted decline in *C. finmarchicus* density is great enough to result in a decrease in right whale presence in the action area over the life of the project is unknown.

Right whale calving occurs off the coast of the Southeastern U.S. In the final rule designating critical habitat, the following features were identified as essential to successful calving: (1) calm sea surface conditions associated with Force 4 or less on the Beaufort Scale, (2) sea surface temperatures from 7 °C through 17 °C; and, (3) water depths of 6 to 28 m where these features simultaneously co-occur over contiguous areas of at least 231 km^2 during the months of November through April. Even with a 2°C shift in mean sea surface temperature, waters off New England in the November to April period will not be warm enough to support calving. While there could be a northward shift in calving over this period, it is not reasonable to expect that over the life of the project that calving would occur in the WDA. Further, given the thermal tolerances of young calves (Garrison 2007) we do not expect that the distribution of young calves would shift northward into the action area such that there would be more or younger calves in the action area.

Based on the available information, it is difficult to predict how the use of the action area by large whales may change over the operational life of the project. However, we do not expect changes in use by sperm or blue whales. Changes in habitat used by sei, fin, and right whales may be related to a northward shift in distribution due to warming waters and a decreased abundance of prey. However, it is also possible that reductions in prey in other areas, including the Gulf of Maine, result in persistence of foraging in the WDA over time. Based on the information available at this time, it seems most likely that the use of the WDA by large whales will decrease or remain stable. As such, we do not expect any changes in abundance or distribution that would result in different effects of the action than those considered in the Effects of the Action section of this Opinion. To the extent new information on climate change, listed species, and their prey becomes available in the future, reinitiation of this consultation may be necessary.

8.0 CUMULATIVE EFFECTS

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 C.F.R. §402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA. As explained in the Endangered Species Section 7 Consultation Handbook (1998): "The concept of cumulative effects is frequently misunderstood as it relates to determining likely jeopardy or adverse modification. Cumulative effects include effects of future State, tribal, local, and private actions, not involving a Federal action that are reasonably certain to occur within the action area under consideration. Future Federal actions requiring separate consultation (unrelated to the proposed action) are not considered in the cumulative effects section." 4-31. It is important to note that, while there may be some overlap, the ESA definition of cumulative effects is not equivalent to the definition of "cumulative impacts" as described in the SouthCoast DEIS the contents of which are governed by the National Environmental Policy Act (NEPA) and the implementing regulations published by the Council on Environmental Quality (CEQ regulations). Under the CEQ regulations, cumulative effects "are effects on the environment that result from the incremental effects of the action when added to the effects of other past, present, and reasonably foreseeable actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions." 40 CFR 1508.1(i)(3). While the effects of past and ongoing Federal projects within the action area for which consultation has been completed are evaluated in both the NEPA and ESA processes (Section 6.0 *Environmental Baseline*), reasonably foreseeable future actions by federal agencies must be considered in the NEPA process but not the ESA Section 7 process.

"Gathering information on cumulative effects often requires more effort than merely gathering information on a proposed action. One of the first places to seek cumulative effects information is in documents provided by the action agency such as NEPA analyses for the action. The Services can review the broader NEPA" Handbook, 4-32. We reviewed the list of past, ongoing, and planned actions identified by BOEM in the SouthCoast DEIS and determined that most (other offshore wind energy development activities; undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); tidal energy projects; marine minerals use and ocean-dredged material disposal; dredging and port development; military use; Federal fisheries use and management, and, oil and gas activities) do not meet the ESA definition of cumulative effects because we expect that if any of these activities were proposed in the action area, or proposed elsewhere yet were to have future effects inside the action area, they would require at least one Federal authorization or permit and would therefore require their own ESA Section 7 consultation. BOEM identifies global climate change as an ongoing action in the DEIS. Because global climate change is not a future state or private activity, we do not consider it a cumulative effect for the purposes of this consultation. Rather, future state or private activities reasonably certain to occur and contribute to climate change's effects in the action area are relevant. However, given the difficulty of parsing out climate change effects due to past and present activities from those of future state and private activities, we discussed the effects of the action in the context of climate change due to past, present, and future activities in Section 7.10, *Consideration of the Effects of the Action*. The remaining cumulative impacts identified in the

FEIS and SEIS (marine transportation, energy and coastal development including dredging and port development, and state and private fisheries use and management) are addressed below.

It is important to note that because any future offshore wind project will require section 7 consultation, these future wind projects do not fit within the ESA definition of cumulative effects and none of them are considered in this Opinion. However, in each successive consultation, the effects on listed species of other offshore wind projects under construction or completed would be considered to the extent they influence the status of the species and/or environmental baseline according to the best available scientific information. We have presented information on other offshore wind projects for which Section 7 consultation has been completed (i.e. the South Fork, Vineyard Wind 1, Ocean Wind 1, Empire Wind, Sunrise Wind, Atlantic Shores South, CVOW, Revolution Wind, Maryland Wind, and New England Wind projects) in the *Environmental Baseline* of this Opinion to provide context for the effects of approved offshore wind projects in general and specifically those activities that are affecting listed species that occur in the action area.

During this consultation, we searched for information on future state, tribal, local, or private (non-Federal) actions reasonably certain to occur in the action area or have effects in the action area. We did not find any information about non-Federal actions other than what has already been described in Section 6 *Environmental Baseline* or incorporated into Section 5 *Status of the Species*. The primary non-Federal activities that will continue to have effects in the action area and that are reasonably certain to occur are: Recreational fisheries, fisheries authorized by states, use of the action area by private vessels, discharge of wastewater and associated pollutants, and coastal development authorized by state and local governments. Any coastal development that requires a Federal authorization, inclusive of a permit from the USACE, would require future Section 7 consultation and would not be considered a cumulative effect. We do not have any information to indicate that effects of these activities over the life of the proposed action will have different effects than those considered in Section 5 *Status of the Species* and Section 6 *Environmental Baseline* sections of this Opinion, inclusive of how those activities may contribute to climate change.

9.0 INTEGRATION AND SYNTHESIS OF EFFECTS

The *Integration and Synthesis* section is the final step in our assessment of the effects and corresponding risk posed to ESA-listed species and designated critical habitat as a result of implementing the proposed action. In Section 4 *Species and Habitat Not Considered Further,* we determined that the project will have no effect on the Gulf of Maine DPS of Atlantic salmon, Oceanic whitetip shark, Gulf sturgeon, Nassau grouper, smalltooth sawfish, any species of corals or any designated critical habitat. We concluded that the SouthCoast project is not likely to adversely affect shortnose sturgeon, hawksbill sea turtles, Rice's whales, or the Giant manta ray; thus, it is also not likely to jeopardize the continued existence of these species. Those species and critical habitat for which we reached a "not likely to adversely affect" conclusion are addressed in Section 4 of this Opinion.

In this section, for species not addressed in Section 4 (i.e. those species for which we have determined the proposed action may affect and is likely to adversely affect), we add the *Effects* *of the Action* (Section 7) to the *Environmental Baseline* (Section 6) and the *Cumulative Effects* (Section 8), while also considering effects in context of climate change and the S*tatus of the Species* (Section 5), to formulate the agency's biological opinion as to whether the proposed action "reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of an ESA-listed species in the wild by reducing its numbers, reproduction, or distribution" (50 CFR §402.02). The purpose of this analysis is to determine whether the action is likely to jeopardize the continued existence of blue, fin, sei, sperm, or North Atlantic right whales, the five DPSs of Atlantic sturgeon, the Northwest Atlantic DPS of loggerhead sea turtles, North Atlantic DPS of green sea turtles, or leatherback or Kemp's ridley sea turtles.

Below, for the listed species that may be adversely affected by the action (i.e. those species affected by the action and for which all effects are not extremely unlikely and/or insignificant), we summarize the status of the species and consider whether the action will result in reductions in reproduction, numbers, or distribution of the species. We then consider whether any reductions in reproduction, numbers, or distribution resulting from the action would reduce appreciably the likelihood of both the survival and recovery of these species, consistent with the definition of "jeopardize the existence of" (50 C.F.R. §402.02) for purposes of Sections 7(a) (2) and 7(b) of the federal Endangered Species Act and its implementing regulations.

In addition, we use the following guidance and regulatory definitions related to survival and recovery to guide our jeopardy analysis. In the NMFS/USFWS Section 7 Handbook, for the purposes of determining whether jeopardy is likely, survival is defined as, "the species' persistence as listed or as a recovery unit, beyond the conditions leading to its endangerment, with sufficient resilience to allow for the potential recovery from endangerment. Said in another way, survival is the condition in which a species continues to exist into the future while retaining the potential for recovery. This condition is characterized by a species with a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, which exists in an environment providing all requirements for completion of the species' entire life cycle, including reproduction, sustenance, and shelter." Recovery is defined in regulation as, "Improvement in the status of listed species to the point at which listing is no longer appropriate under the criteria set out in Section 4(a)(1) of the Act" 50 C.F.R. §402.02.

9.1 Atlantic sturgeon

In Section 7.0 *Effects of the Action* above, we determined that no more than 5 Atlantic sturgeon (3 from the New York Bight DPS, 1 from the Gulf of Maine DPS, and 1 from the Chesapeake Bay, Carolina, or South Atlantic DPS) are likely to be captured and released alive with only minor, recoverable injuries over the five years of the trawl surveys.

While exposure to pile driving noise or UXO detonations may result in a behavioral response from individuals close enough to the noise source to be disturbed, we determined that effects of that noise exposure will be insignificant; no take of any type including harassment, harm, injury, or mortality is expected to result from exposure to project noise, inclusive of UXO detonations. We determined that all effects to habitat and prey will be insignificant or extremely unlikely to occur and determined that vessel strike was extremely unlikely to occur. All effects of project operations, including operational noise and the physical presence of the turbine foundations and electric cables, are extremely unlikely to occur or insignificant.

9.1.1 Gulf of Maine DPS of Atlantic sturgeon

The Gulf of Maine DPS is listed as threatened. While Atlantic sturgeon occur in several rivers in the Gulf of Maine DPS, recent spawning has only been documented in the Kennebec River. There are no abundance estimates for the Gulf of Maine DPS as a whole. The estimated effective population size of the Kennebec River is less than 70 adults, which suggests a relatively small spawning population (NMFS 2022). NMFS estimated adult and subadult abundance of the Gulf of Maine DPS based on available information for the genetic composition and the estimated abundance of Atlantic sturgeon in marine waters (Damon-Randall et al. 2013, Kocik et al. 2013) and concluded that subadult and adult abundance of the Gulf of Maine DPS was 7,455 sturgeon (NMFS 2013). This number encompasses many age classes since, across all DPSs, subadults can be as young as one year old when they first enter the marine environment, and adults can live as long as 64 years (Balazik et al. 2012a; Hilton et al. 2016).

Gulf of Maine DPS Atlantic sturgeon are subject to numerous sources of human induced mortality and habitat disturbance throughout the riverine and marine portions of their range. There is currently not enough information to establish a trend for any life stage or for the DPS as a whole. The ASMFC stock assessment concluded that the abundance of the Gulf of Maine DPS is “depleted” relative to historical levels. The Commission also noted that the Gulf of Maine is particularly data poor among all five DPSs. The assessment concluded that there is a 51 percent probability that the abundance of the Gulf of Maine DPS has increased since implementation of the 1998 fishing moratorium. The Commission also concluded that there is a relatively high likelihood (74 percent probability) that mortality for the Gulf of Maine DPS exceeds the mortality threshold used for the assessment (ASMFC 2017). However, the Commission noted that there was considerable uncertainty related to these numbers, particularly concerning trends data for the Gulf of Maine DPS. For example, the stock assessment notes that it was not clear if: (1) the percent probability for the trend in abundance for the Gulf of Maine DPS is a reflection of the actual trend in abundance or of the underlying data quality for the DPS; and, (2) the percent probability that the Gulf of Maine DPS exceeds the mortality threshold actually reflects lower survival or was due to increased tagging model uncertainty owing to low sample sizes and potential emigration.

As described in the 5-Year Review for the Gulf of Maine DPS (NMFS 2022), the demographic risk for the DPS is “moderate”[55] because of its low productivity (i.e., relatively few adults compared to historical levels), low abundance (i.e., only one known spawning population and low DPS abundance, overall), and limited spatial distribution (i.e., limited spawning habitat within the one river known to support spawning). There is also new information indicating genetic bottlenecks as well as low levels of inbreeding. However, the recovery potential is considered high.

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[55] 84 FR 18243; April 30, 2019 - Listing and Recovery Priority Guidelines.

The effects of the action are in addition to ongoing threats in the action area, which include incidental capture in state and federal fisheries, boat strikes, coastal development, habitat loss, contaminants, and climate change. Entanglement in fishing gear and vessel strikes as described in Section 6.0 *Environmental Baseline* may occur in the action area over the life of the proposed action. As noted in Section 8.0 *Cumulative Effects* of this Opinion, we have not identified any cumulative effects different from those considered in Section 5.0 *Status of the Species* and Section 6.0 *Environmental Baseline* sections of this Opinion, inclusive of how those activities may contribute to climate change. As described in section 7.10, climate change may result in changes in the distribution or abundance of Atlantic sturgeon in the action area over the life of this project; however, we have not identified any different or exacerbated effects of the action due to in the context of anticipated climate change.

We have considered effects of the SouthCoast project over the construction, operations, and decommissioning periods in consideration of the *Environmental Baseline, Cumulative Effects*, and climate change. The only adverse effects of the proposed action on Atlantic sturgeon are the non-lethal capture (and release) of 1 Gulf of Maine DPS Atlantic sturgeon in the trawl survey. We do not anticipate any adverse effects to result from exposure to pile driving, UXO detonation, or any other noise source including HRG surveys and operational noise. We do not expect any Gulf of Maine DPS Atlantic sturgeon to be struck by any project vessels. We do not expect the operation or existence of the turbines and other facilities, including the electric cables, to result in any changes in the abundance, reproduction, or distribution of Atlantic sturgeon in the action area. All effects to Atlantic sturgeon from impacts to habitat and prey will be insignificant.

Live sturgeon captured and released in the trawl survey may experience minor injuries (i.e., scrapes, abrasions); however, they are expected to make a complete recovery without any impairment to future fitness. Capture will temporarily prevent these individuals from carrying out essential behaviors such as foraging and migrating. However, these behaviors are expected to resume as soon as the sturgeon are returned to the water; for trawls the length of capture will be no more than the 20 minute tow time plus a short handling period on board the vessel. The capture of live sturgeon will not reduce the numbers of Atlantic sturgeon in the action area or the numbers of Gulf of Maine DPS Atlantic sturgeon as a whole. Similarly, as the capture of live Atlantic sturgeon will not affect the fitness of any individual, no effects to reproduction are anticipated. The capture of live Atlantic sturgeon is also not likely to affect the distribution of Atlantic sturgeon in the action area or affect the distribution of Atlantic sturgeon throughout their range. As any effects to individual live Atlantic sturgeon removed from the trawl gear will be minor and temporary without any mortality or effects on reproduction, we do not anticipate any population level impacts.

The proposed project will not result in the mortality of any Gulf of Maine DPS Atlantic sturgeon and there will be no effects on reproduction. The proposed action is not likely to reduce distribution, because the action will not impede Gulf of Maine DPS Atlantic sturgeon from accessing any seasonal aggregation areas, including foraging, spawning, or overwintering grounds. Any consequences to distribution will be minor, temporary, and limited to the temporary avoidance of areas with increased noise during pile driving.

Based on the information provided above, the proposed action will not appreciably reduce the likelihood of survival of the Gulf of Maine DPS (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment). The action will not affect the Gulf of Maine DPS Atlantic sturgeon in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, and it will not result in consequences to the environment which would prevent Atlantic sturgeon from completing their entire life cycle or completing essential behaviors including reproducing, foraging and sheltering. This is the case because: (1) the proposed action will not result in any mortality or any associated reduction in potential future reproduction; (2) the proposed action will not change the status or trends of the species as a whole; (3) there will be no effect on the levels of genetic heterogeneity in the population; (4) the action will have only a minor and temporary consequence on the distribution of Gulf of Maine DPS Atlantic sturgeon in the action area and no consequence on the distribution of the species throughout its range; and, (5) the action will have only an insignificant effect on individual foraging or sheltering Gulf of Maine DPS Atlantic sturgeon.

In rare instances, an action that does not appreciably reduce the likelihood of a species' survival might appreciably reduce its likelihood of recovery. As explained above, we have determined that the proposed action will not appreciably reduce the likelihood that the Gulf of Maine DPS of Atlantic sturgeon will survive in the wild, which includes consideration of recovery potential. Here, we consider whether the action will appreciably reduce the likelihood of recovery from the perspective of ESA Section 4. As noted above, recovery is defined as "improvement in the status of listed species to the point at which listing [as threatened or endangered] is no longer appropriate under the criteria set out in Section 4(a)1 of the Act." Thus, we have considered whether the proposed action will appreciably reduce the likelihood that Gulf of Maine DPS Atlantic sturgeon can rebuild to a point where the Gulf of Maine DPS of Atlantic sturgeon is no longer necessary to be listed as a threatened species within the foreseeable future throughout all or a significant portion of its range.

No Recovery Plan for the Gulf of Maine DPS has been published. The Recovery Plan would outline the steps necessary for recovery and the demographic criteria, which once attained would allow the species to be delisted. In January 2018, we published a Recovery Outline for the five DPSs of Atlantic sturgeon (NMFS 2018[56]). This outline is meant to serve as an interim guidance document to direct recovery efforts, including recovery planning, until a full recovery plan is developed and approved. The outline provides a preliminary strategy for recovery of the species. We know that in general, to recover, a listed species must have a sustained positive trend of increasing population over time. To allow that to happen for sturgeon, individuals must have access to enough habitat in suitable condition for foraging, resting and spawning. Conditions must be suitable for the successful development of early life stages. Mortality rates must be low enough to allow for recruitment to all age classes so that successful spawning can continue over time and over generations. There must be enough suitable habitat for spawning, foraging, resting, and migrations of all individuals. For Gulf of Maine DPS Atlantic sturgeon, habitat conditions must be suitable both in the natal river and in other rivers and estuaries where

[56] Available online at: https://media.fisheries.noaa.gov/dam-migration/ats_recovery_outline.pdf; last accessed July 1, 2023

foraging by subadults and adults will occur and in the ocean where subadults and adults migrate, overwinter and forage. Habitat connectivity must also be maintained so that individuals can migrate between important habitats without delays that impact their fitness. As described in the vision statement in the Recovery Outline, subpopulations of all five Atlantic sturgeon DPSs must be present across the historical range. These subpopulations must be of sufficient size and genetic diversity to support successful reproduction and recovery from mortality events. The recruitment of juveniles to the sub-adult and adult life stages must also increase and that increased recruitment must be maintained over many years. Recovery of these DPSs will require conservation of the riverine and marine habitats used for spawning, development, foraging, and growth by abating threats to ensure a high probability of survival into the future. Here, we consider whether this proposed action will reduce the Gulf of Maine DPS likelihood of recovery.

This action will not change the status or trend of the Gulf of Maine DPS. The proposed action will not affect the distribution of Gulf of Maine DPS Atlantic sturgeon across the historical range. The proposed action will not result in mortality or reduction in future reproductive output and will not impair the species' resiliency, genetic diversity, recruitment, or year class strength. The proposed action will have only insignificant effects on habitat and forage and will not impact habitat in a way that makes additional growth of the population less likely, that is, it will not reduce the habitat's carrying capacity. This is because impacts to forage will be insignificant or extremely unlikely, and the area that sturgeon may avoid is small. Any avoidance will be temporary and limited to the period of time when pile driving or UXO detonation is occurring. For these reasons, the action will not reduce the likelihood that the Gulf of Maine DPS can recover. Therefore, the proposed action will not appreciably reduce the likelihood that the Gulf of Maine DPS of Atlantic sturgeon can be brought to the point at which they are no longer listed as threatened; that is, the proposed action will not appreciably reduce the likelihood of recovery of the Gulf of Maine DPS.

Based on the analysis presented herein, the effects of the proposed action are not likely to appreciably reduce the likelihood of both the survival and recovery of the Gulf of Maine DPS of Atlantic sturgeon. These conclusions were made in consideration of the threatened status of the Gulf of Maine DPS of Atlantic sturgeon, the effects of the action, other stressors that individuals are exposed to within the action area as described in the *Environmental Baseline* and *Cumulative Effects*, and any anticipated effects of climate change.

9.1.2 New York Bight DPS of Atlantic sturgeon

The New York Bight DPS is listed as endangered. While Atlantic sturgeon occur in several rivers in the New York Bight DPS, only the Hudson and Delaware rivers are known to support spawning populations. The essential physical features necessary to support spawning and recruitment are also present in the Connecticut and Housatonic Rivers (82 FR 39160; August 17, 2017). Young of year (YOY) Atlantic sturgeon have been captured in the Connecticut River (Savoy *et al.* 2017). Genetic analysis suggests that the YOY belonged to the South Atlantic DPS and at this time, we do not know if these fish were the result of a single spawning event due to unique straying of the adults from the South Atlantic DPS's spawning rivers.

Estimates of effective population size (see Section 5.0 *Status of the Species*) as well as a study that used samples from juvenile Atlantic sturgeon captured in the Delaware from 2009-2019 to infer annual run size estimates, and new genetic analyses for sturgeon collected in mixed aggregations continue to support that the New York Bight DPS is primarily comprised of Atlantic sturgeon that originate from the Hudson River. The results of the coast wide mixed stock analysis and the Delaware River Estuary genetic analysis both indicate that the number of sturgeon that originated from the Delaware River spawning population was approximately one-third of those that originated from the Hudson River (Wirgin et al. 2015a; Wirgin et al. 2015b; Kazyak et al. 2021). The estimates of effective population size[57] for the Hudson River spawning population from separate studies and based on different age classes are relatively similar to each other: 198 (95% CI=171.7-230.7) based on sampling of subadults captured off of Long Island across multiple years, 156 (95% CI=138.3-176.1) based on sampling of natal juveniles in multiple years (O'Leary et al. 2014; Waldman et al. 2019), and 144.2 (95% CI=82.9-286.6) based on samples from a combination of juveniles and adults (ASMFC 2017). Estimates for the Delaware River spawning population by the same authors and using the same methods were: 108.7 (95% CI=74.7-186.1) and 40 (95% CI=34.7-46.2) for samples from subadults and natal juveniles, respectively (O'Leary et al. 2014; Waldman et al. 2019), and 56.7 (95% CI=42.5-77.0) based on samples from a combination of juveniles and adults (ASMFC 2017). Based on the genetic analysis of 45 of the captured juveniles in the Connecticut River, the effective population size for the Connecticut River was estimated to be 2.4 sturgeon (Savoy et al. 2017); the CT DEEP is further investigating the presence of and origins for a spawning population in the Connecticut River.

The 2017 ASMFC stock assessment determined that abundance of the New York Bight DPS is "depleted" relative to historical levels (ASMFC 2017). The assessment also determined there is a relatively high probability (75 percent) that the New York Bight DPS abundance has increased since the implementation of the 1998 fishing moratorium, and a 31 percent probability that mortality for the New York Bight DPS exceeds the mortality threshold used for the assessment (ASMFC 2017). The Commission noted, however, there is significant uncertainty in relation to the trend data. Moreover, new information suggests that the Commission's conclusions primarily reflect the status and trend of only the DPS's Hudson River spawning population.

As described in the 5-Year Review for the New York Bight DPS (NMFS 2022), the demographic risk for the DPS is "high"[58] because of its low productivity (i.e., relatively few adults compared to historical levels and irregular spawning success), low abundance (i.e., only a few known spawning populations and low DPS abundance, overall), and limited spatial distribution (i.e., limited spawning habitat within each of the few rivers known to support spawning). There is also new information indicating genetic bottlenecks as well as low levels of inbreeding in the Delaware and Hudson populations. However, the recovery potential is considered high.
The effects of the action are in addition to ongoing threats in the action area, which include incidental capture in state and federal fisheries, boat strikes, coastal development, habitat loss, contaminants, and climate change. Entanglement in fishing gear and vessel strikes as described in the *Environmental Baseline* may occur in the action area over the life of the proposed action.

[57] Effective population size measures how many adults contributed to producing the next generation based on genetic determinations of parentage from the offspring. Effective population size is always less than the total abundance of a population because it is only a measure of parentage, and it is expected to be less than the total number of adults in a population because not all adults successfully reproduce.
[58] 84 FR 18243; April 30, 2019 - Listing and Recovery Priority Guidelines.

As noted in the Cumulative Effects section of this Opinion, we have not identified any cumulative effects different from those considered in the Status of the Species and Environmental Baseline sections of this Opinion, inclusive of how those activities may contribute to climate change. As described in section 7.10, climate change may result in changes in the distribution or abundance of Atlantic sturgeon in the action area over the life of this project; however, we have not identified any different or exacerbated effects of the action in the context of anticipated climate change.

We have considered effects of the SouthCoast project over the construction, operations, and decommissioning periods in consideration of the Environmental Baseline and in consideration of Cumulative Effects and climate change. The only adverse effects of the proposed action on New York Bight DPS Atlantic sturgeon are the non-lethal capture and release of 3 New York Bight DPS Atlantic sturgeon in the trawl survey. We do not anticipate any adverse effects to result from exposure to pile driving, or any other noise source including HRG surveys and operational noise. We do not expect any Atlantic sturgeon to be struck by any project vessels. We do not expect the operation or existence of the turbines and other facilities, including the electric cables, to result in any adverse effects to Atlantic sturgeon. All effects to Atlantic sturgeon from impacts to habitat and prey will be insignificant. No serious injury or mortality of any Atlantic sturgeon is expected from any project activity.

Live sturgeon captured and released in the trawl surveys may have minor injuries (i.e., scrapes, abrasions); however, they are expected to make a complete recovery without any impairment to future fitness. Capture will temporarily prevent these individuals from carrying out essential behaviors such as foraging and migrating. However, these behaviors are expected to resume as soon as the sturgeon are returned to the water; the length of capture will be no more than the 20 minute tow time plus a short handing period on board the survey vessel. The capture and release of live sturgeon will not reduce the numbers of Atlantic sturgeon in the action area or the numbers of New York Bight DPS Atlantic sturgeon as a whole. Similarly, as the capture of live Atlantic sturgeon will not affect the fitness of any individual, no effects to reproduction are anticipated. The capture of live Atlantic sturgeon is also not likely to affect the distribution of Atlantic sturgeon in the action area or affect the distribution of Atlantic sturgeon throughout their range. As any effects to individual live Atlantic sturgeon removed from the trawl gear will be minor and temporary without any mortality or effects on reproduction, we do not anticipate any population level impacts.

As there will be no mortality, there will be no reduction in the number of New York Bight DPS Atlantic sturgeon. The reproductive potential of the New York Bight DPS will not be affected in any way. The proposed action will not affect the spawning grounds within the Hudson or Delaware River where New York Bight DPS fish spawn. The action will also not create any barrier to pre-spawning sturgeon accessing the overwintering sites or the spawning grounds. Any impacts to behavior will be minor and temporary and there will not be any delay or disruption of any normal behavior including spawning; there will also be no reduction in individual fitness or any future reduction in numbers of individuals.

The proposed action is not likely to reduce distribution because the action will not impede New York Bight DPS Atlantic sturgeon from accessing any seasonal concentration areas, including foraging, spawning, or overwintering grounds. Any consequences to distribution will be minor and temporary and limited to the temporary avoidance of areas with increased noise during pile driving.

Based on the information provided above, the SouthCoast project will not appreciably reduce the likelihood of survival of the New York Bight DPS (*i.e.*, it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment). The action will not affect New York Bight DPS Atlantic sturgeon in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, and it will not result in consequences to the environment which would prevent Atlantic sturgeon from completing their entire life cycle or completing essential behaviors including reproducing, foraging and sheltering. This is the case because: (1) there will be no mortality of New York Bight DPS Atlantic sturgeon; (2) there will be no change to the status or trends of the species as a whole; (3) there will be no consequence on the levels of genetic heterogeneity in the population; (4) there will be no consequence on reproductive output; (6) the action will have only a minor and temporary consequence on the distribution of New York Bight DPS Atlantic sturgeon in the action area and no consequence on the distribution of the species throughout its range; and, (7) the action will have only an insignificant effect on individual foraging or sheltering New York Bight DPS Atlantic sturgeon.

In rare instances, an action that does not appreciably reduce the likelihood of a species' survival might appreciably reduce its likelihood of recovery. As explained above, we have determined that the proposed action will not appreciably reduce the likelihood that the New York Bight DPS of Atlantic sturgeon will survive in the wild, which includes consideration of recovery potential. Here, we consider whether the action will appreciably reduce the likelihood of recovery from the perspective of ESA Section 4. As noted above, recovery is defined as "Improvement in the status of listed species to the point at which listing [as threatened or endangered] is no longer appropriate under the criteria set out in Section 4(a)(1) of the Act." Thus, we have considered whether the proposed action will appreciably reduce the likelihood that the New York Bight DPS can rebuild to a point where listing of the New York Bight DPS of Atlantic sturgeon as endangered or threatened is no longer appropriate.

No Recovery Plan for the New York Bight DPS has been published. The Recovery Plan would outline the steps necessary for recovery and the demographic criteria, which once attained would allow the species to be delisted. In January 2018, we published a Recovery Outline for the five DPSs of Atlantic sturgeon (NMFS 2018). This outline is meant to serve as an interim guidance document to direct recovery efforts, including recovery planning, until a full recovery plan is developed and approved. The outline provides a preliminary strategy for recovery of the species. We know that in general, to recover, a listed species must have a sustained positive trend of increasing population over time. To allow that to happen for sturgeon, individuals must have access to enough habitat in suitable condition for foraging, resting and spawning. Conditions must be suitable for the successful development of early life stages. Mortality rates must be low enough to allow for recruitment to all age classes so that successful spawning can continue over time and over generations. There must be enough suitable habitat for spawning, foraging, resting, and migrations of all individuals. For New York Bight DPS Atlantic sturgeon, habitat conditions must be suitable both in the natal river and in other rivers and estuaries where foraging by subadults and adults will occur and in the ocean where subadults and adults migrate, overwinter and forage. Habitat connectivity must also be maintained so that individuals can migrate between important habitats without delays that impact their fitness. As described in the vision statement in the Recovery Outline, subpopulations of all five Atlantic sturgeon DPSs must be present across the historical range. These subpopulations must be of sufficient size and genetic diversity to support successful reproduction and recovery from mortality events. The recruitment of juveniles to the sub-adult and adult life stages must also increase and that increased recruitment must be maintained over many years. Recovery of these DPSs will require conservation of the riverine and marine habitats used for spawning, development, foraging, and growth by abating threats to ensure a high probability of survival into the future. Here, we consider whether this proposed action will affect the New York Bight DPS likelihood of recovery.

This action will not change the status or trend of the New York Bight DPS. The proposed action will not affect the distribution of Atlantic sturgeon across the historical range. The proposed action will not result in any mortality and no reduction in future reproductive output or genetic diversity. The proposed action will have only insignificant effects on habitat and forage and will not impact habitat in a way that makes additional growth of the population less likely, that is, it will not reduce the habitat's carrying capacity. This is because impacts to forage will be insignificant or extremely unlikely and the area that sturgeon may avoid is small and any avoidance will be temporary and limited to the period of time when pile driving is occurring. The proposed action will not result in any permanent loss of habitat. For these reasons, the action will not reduce the likelihood that the New York Bight DPS can recover. Therefore, the proposed action will not appreciably reduce the likelihood that the New York Bight DPS of Atlantic sturgeon can be brought to the point at which they are no longer listed as threatened or endangered; that is, the proposed action will not appreciably reduce the likelihood of recovery of the New York Bight DPS.

Based on the analysis presented herein, the effects of the proposed action are not likely to appreciably reduce the likelihood of both the survival and recovery of the New York Bight DPS of Atlantic sturgeon. These conclusions were made in consideration of the endangered status of the New York Bight DPS of Atlantic sturgeon, the effects of the action, other stressors that individuals are exposed to within the action area as described in the *Environmental Baseline* and *Cumulative Effects*, and any anticipated effects of climate change.

9.1.3 Chesapeake Bay DPS of Atlantic sturgeon

The Chesapeake Bay DPS is listed as endangered. While Atlantic sturgeon occur in several rivers in the Chesapeake Bay DPS, at the time of listing spawning was only known to occur in the James River. Since the listing, there is evidence of additional spawning populations for the Chesapeake Bay DPS, including the Pamunkey River, a tributary of the York River, and in Marshyhope Creek, a tributary of the Nanticoke River (Hager et al. 2014; Kahn et al. 2014; Richardson and Secor 2016; Secor et al. 2021). New detections of acoustically-tagged adult Atlantic sturgeon along with historical evidence suggests that Atlantic sturgeon belonging to the Chesapeake Bay DPS may be spawning in the Mattaponi and Rappahannock rivers as well

(Hilton et al. 2016; ASMFC 2017; Kahn et al. 2019). However, information for these populations is limited and the research is ongoing.

There are no abundance estimates for the entire Chesapeake Bay DPS or for the spawning populations in the James River or the Nanticoke River system. Based on research captures of tagged adults, an estimated 75 Chesapeake Bay DPS Atlantic sturgeon spawned in the Pamunkey River in 2013 (Kahn et al. 2014). More recent information provided annual run estimates for the Pamunkey River from 2013 to 2018. The results suggest a spawning run of up to 222 adults but with yearly variability, likely due to spawning periodicity (Kahn et al. 2019). New information for the Nanticoke River system suggests a small adult population based on a small total number of captures (i.e., 26 sturgeon) and the high rate of recapture across several years of study (Secor et al. 2021). By comparison, a total of 369 adult-sized Atlantic sturgeon were captured in the James River from 2010 through spring 2014 (Balazik and Musick 2015). This is a minimum count of the number of adult Atlantic sturgeon in the James River during the time period because capture efforts did not occur in all areas and at all times when Atlantic sturgeon were present in the river.

NMFS estimated adult and subadult abundance of the Chesapeake Bay DPS based on available information for the genetic composition and the estimated abundance of Atlantic sturgeon in marine waters (Damon-Randall et al. 2013, Kocik et al. 2013) and concluded that subadult and adult abundance of the Chesapeake Bay DPS was 8,811 sturgeon (NMFS 2013). This number encompasses many age classes since, across all DPSs, subadults can be as young as one year old when they first enter the marine environment, and adults can live as long as 64 years (Balazik et al. 2012c; Hilton et al. 2016).

Very few data sets are available that cover the full potential life span of an Atlantic sturgeon. The ASMFC concluded for the Stock Assessment that it could not estimate abundance of the Chesapeake Bay DPS or otherwise quantify the trend in abundance because of the limited available information. However, the Stock Assessment was a comprehensive review of the available information, and used multiple methods and analyses to assess the status of the Chesapeake Bay DPS and the coast wide stock of Atlantic sturgeon. For example, the Stock Assessment Subcommittee defined a benchmark, the mortality threshold, against which mortality for the coast wide stock of Atlantic sturgeon as well as for each DPS were compared[59] to assess whether the current mortality experienced by the coast wide stock and each DPS is greater than what it can sustain. This information informs the current trend of the Chesapeake Bay DPS.

In the Stock Assessment, the ASMFC concluded that abundance of the Chesapeake Bay DPS is "depleted" relative to historical levels and there is a relatively low probability (37 percent) that abundance of the Chesapeake Bay DPS has increased since the implementation of the 1998 fishing moratorium. However, the ASMFC also concluded that there is a relatively high likelihood (70 percent probability) that mortality for the Chesapeake Bay DPS does not exceed the mortality threshold used for the Stock Assessment (ASMFC 2017).

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[59] The analysis considered both a coast wide mortality threshold and a region-specific mortality threshold to evaluate the sensitivity of the model to differences in life history parameters among the different DPSs (e.g., Atlantic sturgeon in the northern region are slower growing, longer lived; Atlantic sturgeon in the southern region are faster growing, shorter lived).

As described in the 5-Year Review for the Chesapeake Bay DPS (NMFS 2022), the demographic risk for the DPS is "High" because of its low productivity (e.g., relatively few adults compared to historical levels and irregular spawning success), low abundance (e.g., only three known spawning populations and low DPS abundance, overall), and limited spatial distribution (e.g. limited spawning habitat within each of the few known rivers that support spawning). There is also new information indicating genetic bottlenecks as well as low levels of inbreeding. However, the recovery potential is considered high.

The effects of the action are in addition to the ongoing threats in the action area, which include incidental capture in state and federal fisheries, boat strikes, coastal development, habitat loss, contaminants, and climate change. Entanglement in fishing gear and vessel strikes as described in the *Environmental Baseline*, may occur in the action area over the life of the proposed action. As noted in the Cumulative Effects section of this Opinion, we have not identified any cumulative effects different from those considered in the Status of the Species and Environmental Baseline sections of this Opinion, inclusive of how those activities may contribute to climate change. As described in section 7.10, climate change may result in changes in the distribution or abundance of Atlantic sturgeon in the action area over the life of this project; however, we have not identified any different or exacerbated effects of the action in the context of anticipated climate change.

We have considered effects of the SouthCoast project over the construction, operations, and decommissioning periods in consideration of the effects already accounted for in the Environmental Baseline and in consideration of Cumulative Effects and climate change. The only adverse effects of the proposed action on Chesapeake Bay DPS Atlantic sturgeon are the non-lethal capture of 1 Chesapeake Bay DPS Atlantic sturgeon in the trawl survey. We do not anticipate any adverse effects to result from exposure to pile driving, UXO detonation, or any other noise source including HRG surveys and operational noise. We do not expect any Chesapeake Bay DPS Atlantic sturgeon to be struck by any project vessels. We do not expect the operation or existence of the turbines and other facilities, including the electric cables, to result in any changes in the abundance, reproduction, or distribution of Atlantic sturgeon in the action area. All effects to Atlantic sturgeon from impacts to habitat and prey will be insignificant.

Live sturgeon captured and released in the trawl survey may experience minor injuries (i.e., scrapes, abrasions); however, they are expected to make a complete recovery without any impairment to future fitness. Capture will temporarily prevent these individuals from carrying out essential behaviors such as foraging and migrating. However, these behaviors are expected to resume as soon as the sturgeon are returned to the water; for trawls the length of capture will be no more than the 20 minute tow time plus a short handling period on board the vessel. The capture of live sturgeon will not reduce the numbers of Atlantic sturgeon in the action area or the numbers of Chesapeake Bay DPS Atlantic sturgeon as a whole. Similarly, as the capture of live Atlantic sturgeon will not affect the fitness of any individual, no effects to reproduction are anticipated. The capture of live Atlantic sturgeon is also not likely to affect the distribution of Atlantic sturgeon in the action area or affect the distribution of Atlantic sturgeon throughout their range. As any effects to individual live Atlantic sturgeon removed from the trawl gear will be minor and temporary without any mortality or effects on reproduction, we do not anticipate any population level impacts.

The proposed project will not result in the mortality of any Chesapeake Bay DPS Atlantic sturgeon. There will be no effects on reproduction. The proposed action is not likely to reduce distribution, because the action will not impede Chesapeake Bay DPS Atlantic sturgeon from accessing any seasonal aggregation areas, including foraging, spawning, or overwintering grounds. Any consequences to distribution will be minor and temporary and limited to the temporary avoidance of areas with increased noise during pile driving.

Based on the information provided above, the proposed action will not appreciably reduce the likelihood of survival of the Chesapeake Bay DPS (*i.e.*, it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery). The action will not affect the Chesapeake Bay DPS Atlantic sturgeon in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, and it will not result in consequences to the environment which would prevent Atlantic sturgeon from completing their entire life cycle or completing essential behaviors including reproducing, foraging and sheltering. This is the case because: (1) the proposed action will not result in any mortality and associated potential future reproduction; (2) the proposed action will not change the status or trends of the species as a whole; (3) there will be no effect on the levels of genetic heterogeneity in the population; (4) the action will have only a minor and temporary consequence on the distribution of Chesapeake Bay DPS Atlantic sturgeon in the action area and no consequence on the distribution of the species throughout its range; and, (5) the action will have only an insignificant effect on individual foraging or sheltering Chesapeake Bay DPS Atlantic sturgeon.

In rare instances, an action that does not appreciably reduce the likelihood of a species' survival might appreciably reduce its likelihood of recovery. As explained above, we have determined that the proposed action will not appreciably reduce the likelihood that the Chesapeake Bay DPS of Atlantic sturgeon will survive in the wild, which includes consideration of recovery potential. Here, we consider whether the action will appreciably reduce the likelihood of recovery from the perspective of ESA Section 4. As noted above, recovery is defined as the "Improvement in the status of listed species to the point at which listing [as threatened or endangered] is no longer appropriate under the criteria set out in Section 4(a)(1) of the Act." Thus, we have considered whether the proposed action will appreciably reduce the likelihood that Chesapeake Bay DPS Atlantic sturgeon can rebuild to a point where the listing of the Chesapeake Bay DPS of Atlantic sturgeon as threatened or endangered is no longer appropriate.

No Recovery Plan for the Chesapeake Bay DPS has been published. The Recovery Plan would outline the steps necessary for recovery and the demographic criteria, which once attained would allow the species to be delisted. In January 2018, we published a Recovery Outline for the five DPSs of Atlantic sturgeon (NMFS 2018). This outline is meant to serve as an interim guidance document to direct recovery efforts, including recovery planning, until a full recovery plan is developed and approved. The outline provides a preliminary strategy for recovery of the species. We know that in general, to recover, a listed species must have a sustained positive trend of increasing population over time. To allow that to happen for sturgeon, individuals must have access to enough habitat in suitable condition for foraging, resting and spawning. Conditions must be suitable for the successful development of early life stages. Mortality rates must be low enough to allow for recruitment to all age classes so that successful spawning can continue over time and over generations. There must be enough suitable habitat for spawning, foraging, resting, and migrations of all individuals. For Chesapeake Bay DPS Atlantic sturgeon, habitat conditions must be suitable both in the natal river and in other rivers and estuaries where foraging by subadults and adults will occur and in the ocean where subadults and adults migrate, overwinter and forage. Habitat connectivity must also be maintained so that individuals can migrate between important habitats without delays that impact their fitness. As described in the vision statement in the Recovery Outline, subpopulations of all five Atlantic sturgeon DPSs must be present across the historical range. These subpopulations must be of sufficient size and genetic diversity to support successful reproduction and recovery from mortality events. The recruitment of juveniles to the sub-adult and adult life stages must also increase and that increased recruitment must be maintained over many years. Recovery of these DPSs will require conservation of the riverine and marine habitats used for spawning, development, foraging, and growth by abating threats to ensure a high probability of survival into the future. Here, we consider whether this proposed action will reduce the Chesapeake Bay DPS likelihood of recovery.

This action will not change the status or trend of the Chesapeake Bay DPS. The proposed action will not affect the distribution of Atlantic sturgeon across the historical range. The proposed action will not result in mortality or reduction in future reproductive output and will not impair the species' resiliency, genetic diversity, recruitment, or year class strength. The proposed action will have only insignificant effects on habitat and forage and will not impact habitat in a way that makes additional growth of the population less likely, that is, it will not reduce the habitat's carrying capacity. This is because impacts to forage will be insignificant or extremely unlikely, and the area that sturgeon may avoid is small. Any avoidance will be temporary and limited to the period of time when pile driving or UXO detonation is occurring. For these reasons, the action will not reduce the likelihood that the Chesapeake Bay DPS can recover. Therefore, the proposed action will not appreciably reduce the likelihood that the Chesapeake Bay DPS of Atlantic sturgeon can be brought to the point at which they are no longer listed as threatened or endangered; that is, the proposed action will not appreciably reduce the likelihood of recovery of the Chesapeake Bay DPS.

Based on the analysis presented herein, the effects of the proposed action are not likely to appreciably reduce the likelihood of both the survival and recovery of the Chesapeake Bay DPS of Atlantic sturgeon. These conclusions were made in consideration of the endangered status of the Chesapeake Bay DPS of Atlantic sturgeon, the effects of the action and other stressors that individuals are exposed to within the action area as described in the *Environmental Baseline* and *Cumulative Effects*, and any anticipated effects of climate change.

9.1.4 Carolina DPS of Atlantic sturgeon

The Carolina DPS is listed as endangered. Atlantic sturgeon from the Carolina DPS spawn in the rivers of North Carolina south to the Cooper River, South Carolina. There are currently seven spawning subpopulations within the Carolina DPS: Roanoke River, Tar-Pamlico River, Neuse River, Northeast Cape Fear and Cape Fear Rivers, Waccamaw and Great Pee Dee Rivers, Black River, Santee and Cooper Rivers. NMFS estimated adult and subadult abundance of the Carolina DPS based on available information for the genetic composition and the estimated abundance of Atlantic sturgeon in marine waters (Damon-Randall et al. 2013, Kocik et al. 2013) and concluded that subadult and adult abundance of the Carolina DPS was 1,356 sturgeon (NMFS 2013). This number encompasses many age classes since, across all DPSs, subadults can be as young as one year old when they first enter the marine environment, and adults can live as long as 64 years (Balazik et al. 2012c; Hilton et al. 2016).

Very few data sets are available that cover the full potential life span of an Atlantic sturgeon. The ASMFC concluded for the Stock Assessment that it could not estimate abundance of the Carolina DPS or otherwise quantify the trend in abundance because of the limited available information. However, the Stock Assessment was a comprehensive review of the available information, and used multiple methods and analyses to assess the status of the Carolina DPS and the coast wide stock of Atlantic sturgeon. For example, the Stock Assessment Subcommittee defined a benchmark, the mortality threshold, against which mortality for the coast wide stock of Atlantic sturgeon as well as for each DPS were compared[60] to assess whether the current mortality experienced by the coast wide stock and each DPS is greater than what it can sustain. This information informs the current trend of the Carolina DPS.

In the Stock Assessment, the ASMFC concluded that abundance of the Carolina DPS is "depleted" relative to historical levels and there is a relatively low probability (36 percent) that abundance of the Carolina DPS has increased since the implementation of the 1998 fishing moratorium. The ASMFC also concluded that there is a relatively low likelihood (25 percent probability) that mortality for the Carolina DPS does not exceed the mortality threshold used for the Stock Assessment (ASMFC 2017).

As described in the 5-Year Review for the Carolina DPS (NMFS 2023), the demographic risk for the DPS is “High” because of its productivity (i.e., relatively few adults compared to historical levels and irregular spawning success), abundance (i.e., riverine populations vary significantly and abundance is generally low in the DPS, overall), and spatial distribution (i.e., riverine populations and connectivity vary, creating inconsistent population coverage across the DPS and potentially limited ability to repopulate extirpated river populations). However, the recovery potential is considered high.

The effects of the action are in addition to the ongoing threats in the action area, which include incidental capture in state and federal fisheries, boat strikes, coastal development, habitat loss, contaminants, and climate change. Entanglement in fishing gear and vessel strikes as described in the *Environmental Baseline*, may occur in the action area over the life of the proposed action. As noted in the Cumulative Effects section of this Opinion, we have not identified any cumulative effects different from those considered in the Status of the Species and Environmental Baseline sections of this Opinion, inclusive of how those activities may

[60] The analysis considered both a coast wide mortality threshold and a region-specific mortality threshold to evaluate the sensitivity of the model to differences in life history parameters among the different DPSs (e.g., Atlantic sturgeon in the northern region are slower growing, longer lived; Atlantic sturgeon in the southern region are faster growing, shorter lived).

contribute to climate change. As described in section 7.10, climate change may result in changes in the distribution or abundance of Atlantic sturgeon in the action area over the life of this project; however, we have not identified any different or exacerbated effects of the action in the context of anticipated climate change.

We have considered effects of the SouthCoast project over the construction, operations, and decommissioning periods in consideration of the effects already accounted for in the *Environmental Baseline* and in consideration of *Cumulative Effects* and climate change. The only adverse effects of the proposed action on Carolina DPS Atlantic sturgeon are the non-lethal capture of 1 Carolina DPS Atlantic sturgeon in the trawl survey. We do not anticipate any adverse effects to result from exposure to pile driving, UXO detonation, or any other noise source including HRG surveys and operational noise. We do not expect any Carolina DPS Atlantic sturgeon to be struck by any project vessels. We do not expect the operation or existence of the turbines and other facilities, including the electric cables, to result in any changes in the abundance, reproduction, or distribution of Atlantic sturgeon in the action area. All effects to Atlantic sturgeon from impacts to habitat and prey will be insignificant.

Live sturgeon captured and released in the trawl survey may experience minor injuries (i.e., scrapes, abrasions); however, they are expected to make a complete recovery without any impairment to future fitness. Capture will temporarily prevent these individuals from carrying out essential behaviors such as foraging and migrating. However, these behaviors are expected to resume as soon as the sturgeon are returned to the water; for trawls the length of capture will be no more than the 20 minute tow time plus a short handling period on board the vessel. The capture of live sturgeon will not reduce the numbers of Atlantic sturgeon in the action area or the numbers of Carolina DPS Atlantic sturgeon as a whole. Similarly, as the capture of live Atlantic sturgeon will not affect the fitness of any individual, no effects to reproduction are anticipated. The capture of live Atlantic sturgeon is also not likely to affect the distribution of Atlantic sturgeon in the action area or affect the distribution of Atlantic sturgeon throughout their range. As any effects to individual live Atlantic sturgeon removed from the trawl gear will be minor and temporary without any mortality or effects on reproduction, we do not anticipate any population level impacts.

The proposed project will not result in the mortality of any Carolina DPS Atlantic sturgeon. There will be no effects on reproduction of any Carolina DPS Atlantic sturgeon. The proposed action is not likely to reduce distribution, because the action will not impede Carolina DPS Atlantic sturgeon from accessing any seasonal aggregation areas, including foraging, spawning, or overwintering grounds. Any consequences to distribution will be minor and temporary and limited to the temporary avoidance of areas with increased noise during pile driving.

Based on the information provided above, the proposed action will not appreciably reduce the likelihood of survival of the Carolina DPS (*i.e.*, it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment). The action will not affect the Carolina DPS Atlantic sturgeon in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, and it will not result in consequences to the environment which would prevent Atlantic sturgeon from completing their entire life cycle or completing essential behaviors including reproducing, foraging and sheltering. This is the case because: (1) the proposed action will not result in any mortality and associated potential future reproduction; (2) the proposed action will not change the status or trends of the species as a whole; (3) there will be no effect on the levels of genetic heterogeneity in the population; (4) the action will have only a minor and temporary consequence on the distribution of Carolina DPS Atlantic sturgeon in the action area and no consequence on the distribution of the species throughout its range; and, (5) the action will have only an insignificant effect on individual foraging or sheltering Carolina DPS Atlantic sturgeon.

In rare instances, an action that does not appreciably reduce the likelihood of a species' survival might appreciably reduce its likelihood of recovery. As explained above, we have determined that the proposed action will not appreciably reduce the likelihood that the Carolina DPS of Atlantic sturgeon will survive in the wild, which includes consideration of recovery potential. Here, we consider whether the action will appreciably reduce the likelihood of recovery from the perspective of ESA Section 4. As noted above, recovery is defined as "Improvement in the status of listed species to the point at which listing [as threatened or endangered] is no longer appropriate under the criteria set out in Section 4(a)(1) of the Act." Thus, we have considered whether the proposed action will appreciably reduce the likelihood that Carolina DPS Atlantic sturgeon can rebuild to a point where listing of the Carolina DPS of Atlantic sturgeon as threatened or endangered is no longer appropriate.

No Recovery Plan for the Carolina DPS has been published. The Recovery Plan would outline the steps necessary for recovery and the demographic criteria, which once attained would allow the species to be delisted. In January 2018, we published a Recovery Outline for the five DPSs of Atlantic sturgeon (NMFS 2018). This outline is meant to serve as an interim guidance document to direct recovery efforts, including recovery planning, until a full recovery plan is developed and approved. The outline provides a preliminary strategy for recovery of the species. We know that in general, to recover, a listed species must have a sustained positive trend of increasing population over time. To allow that to happen for sturgeon, individuals must have access to enough habitat in suitable condition for foraging, resting and spawning. Conditions must be suitable for the successful development of early life stages. Mortality rates must be low enough to allow for recruitment to all age classes so that successful spawning can continue over time and over generations. There must be enough suitable habitat for spawning, foraging, resting, and migrations of all individuals. For Carolina DPS Atlantic sturgeon, habitat conditions must be suitable both in the natal river and in other rivers and estuaries where foraging by subadults and adults will occur and in the ocean where subadults and adults migrate, overwinter and forage. Habitat connectivity must also be maintained so that individuals can migrate between important habitats without delays that impact their fitness. As described in the vision statement in the Recovery Outline, subpopulations of all five Atlantic sturgeon DPSs must be present across the historical range. These subpopulations must be of sufficient size and genetic diversity to support successful reproduction and recovery from mortality events. The recruitment of juveniles to the sub-adult and adult life stages must also increase and that increased recruitment must be maintained over many years. Recovery of these DPSs will require conservation of the riverine and marine habitats used for spawning, development, foraging, and growth by abating threats to ensure a high probability of survival into the future. Here, we consider whether this proposed action will reduce the Carolina DPS likelihood of recovery.

This action will not change the status or trend of the Carolina DPS. The proposed action will not affect the distribution of Atlantic sturgeon across the historical range. The proposed action will not result in mortality or reduction in future reproductive output of the Carolina DPS and will not impair the species' resiliency, genetic diversity, recruitment, or year class strength. The proposed action will have only insignificant effects on habitat and forage and will not impact habitat in a way that makes additional growth of the population less likely, that is, it will not reduce the habitat's carrying capacity. This is because impacts to forage will be insignificant or extremely unlikely, and the area that sturgeon may avoid is small. Any avoidance will be temporary and limited to the period of time when pile driving or UXO detonation is occurring. For these reasons, the action will not reduce the likelihood that the Carolina DPS can recover. Therefore, the proposed action will not appreciably reduce the likelihood that the Carolina DPS of Atlantic sturgeon can be brought to the point at which they are no longer listed as threatened; that is, the proposed action will not appreciably reduce the likelihood of recovery of the Carolina DPS.

Based on the analysis presented herein, the effects of the proposed action are not likely to appreciably reduce the likelihood of both the survival and recovery of the Carolina DPS of Atlantic sturgeon. These conclusions were made in consideration of the endangered status of the Carolina DPS of Atlantic sturgeon, the effects of the action, other stressors that individuals are exposed to within the action area as described in the *Environmental Baseline* and *Cumulative Effects,* and any anticipated effects of climate change.

9.1.5 South Atlantic DPS of Atlantic sturgeon

The South Atlantic DPS Atlantic sturgeon is listed as endangered. The South Atlantic DPS originates from at least six rivers where spawning is thought to still occur: the Combahee River, Edisto River, Savannah River, Ogeechee River, Altamaha River, and Satilla River. The spawning subpopulation in the St. Marys River is continues to exist, albeit at very low levels. Two of the spawning subpopulations in the South Atlantic DPS are relatively robust and are considered the second (Altamaha River) and third (Combahee/Edisto River) largest spawning subpopulations across all five DPSs. There are an estimated 343 adults that spawn annually in the Altamaha River and less than 300 adults spawning annually (total of both sexes) in the river systems where spawning still occurs. No census of the number of Atlantic sturgeon in any of the other spawning rivers or for the DPS as a whole is available. NMFS estimated adult and subadult abundance of the South Atlantic DPS based on available information for the genetic composition and the estimated abundance of Atlantic sturgeon in marine waters (Damon-Randall et al. 2013, Kocik et al. 2013) and concluded that subadult and adult abundance of the South Atlantic DPS was 14,911 sturgeon (NMFS 2013). This number encompasses many age classes since, across all DPSs, subadults can be as young as one year old when they first enter the marine environment, and adults can live as long as 64 years (Balazik et al. 2012c; Hilton et al. 2016).

The 2017 ASMFC stock assessment determined that abundance of the South Atlantic DPS is "depleted" relative to historical levels (ASMFC 2017). Due to a lack of suitable indices, the assessment was unable to determine the probability that the abundance of the South Atlantic DPS has increased since the implementation of the 1998 fishing moratorium. However, it was estimated that there is a 40 percent probability that mortality for the South Atlantic DPS exceeds the mortality threshold used for the assessment (ASMFC 2017). We note that the Commission expressed significant uncertainty in relation to the trends data.

We have considered effects of the SouthCoast project over the construction, operations, and decommissioning periods in consideration of the *Environmental Baseline*, *Cumulative Effects*, the endangered status of the DPS and climate change. We do not anticipate any adverse effects from the project; all effects of the proposed action on the Gulf of Maine DPS of Atlantic sturgeon will be extremely unlikely to occur (discountable) and/or insignificant. We do not anticipate any adverse effects to result from exposure to pile driving or any other noise source including HRG surveys and operational noise. We do not expect any Gulf of Maine DPS Atlantic sturgeon to be struck by any project vessels. We do not expect the operation or existence of the turbines and other facilities, including the electric cables, to result in any adverse effects to Gulf of Maine DPS Atlantic sturgeon. All effects to Gulf of Maine DPS Atlantic sturgeon from impacts to habitat and prey will be insignificant. As all effects of the SouthCoast project on the Gulf of Maine DPS of Atlantic sturgeon will be insignificant or discountable, the SouthCoast project is not likely to adversely affect the Gulf of Maine DPS; thus, it is also not likely to jeopardize the continued existence of the Gulf of Maine DPS of Atlantic sturgeon.

As described in the 5-year review for the South Atlantic DPS (NFMS 2023), the DPS' demographic risk is "High" because of its productivity (i.e., relatively few adults compared to historical levels and irregular spawning success), abundance (i.e., riverine populations vary significantly and abundance is generally low in the DPS, overall), and spatial distribution (i.e., riverine populations and connectivity vary, creating inconsistent population coverage across the DPS and potentially limited ability to repopulate extirpated river populations). However, the potential to recover is also "high."

The effects of the action are in addition to the ongoing threats in the action area, which include incidental capture in state and federal fisheries, boat strikes, coastal development, habitat loss, contaminants, and climate change. Entanglement in fishing gear and vessel strikes as described in the *Environmental Baseline* may occur in the action area over the life of the proposed action. As noted in the Cumulative Effects section of this Opinion, we have not identified any cumulative effects different from those considered in the Status of the Species and Environmental Baseline sections of this Opinion, inclusive of how those activities may contribute to climate change. As described in section 7.10, climate change may result in changes in the distribution or abundance of Atlantic sturgeon in the action area over the life of this project; however, we have not identified any different or exacerbated effects of the action in the context of anticipated climate change.

We have considered effects of the SouthCoast project over the construction, operations, and decommissioning periods in consideration of the effects already accounted for in the Environmental Baseline and in consideration of Cumulative Effects and climate change. The only adverse effects of the proposed action on Atlantic sturgeon are the non-lethal capture of 1 South Atlantic DPS Atlantic sturgeon in the trawl survey. We do not anticipate any adverse effects to result from exposure to pile driving, UXO detonation, or any other noise source including HRG surveys and operational noise. We do not expect any South Atlantic DPS Atlantic sturgeon to be struck by any project vessels. We do not expect the operation or existence of the turbines and other facilities, including the electric cables, to result in any changes in the abundance, reproduction, or distribution of Atlantic sturgeon in the action area. All effects to Atlantic sturgeon from impacts to habitat and prey will be insignificant.

Live sturgeon captured and released in the trawl survey may experience minor injuries (i.e., scrapes, abrasions); however, they are expected to make a complete recovery without any impairment to future fitness. Capture will temporarily prevent these individuals from carrying out essential behaviors such as foraging and migrating. However, these behaviors are expected to resume as soon as the sturgeon are returned to the water; for trawls the length of capture will be no more than the 20 minute tow time plus a short handling period on board the vessel. The capture of live sturgeon will not reduce the numbers of Atlantic sturgeon in the action area or the numbers of South Atlantic DPS Atlantic sturgeon as a whole. Similarly, as the capture of live Atlantic sturgeon will not affect the fitness of any individual, no effects to reproduction are anticipated. The capture of live Atlantic sturgeon is also not likely to affect the distribution of Atlantic sturgeon in the action area or affect the distribution of Atlantic sturgeon throughout their range. As any effects to individual live Atlantic sturgeon removed from the trawl gear will be minor and temporary without any mortality or effects on reproduction, we do not anticipate any population level impacts.

The proposed project will not result in the mortality of any Atlantic sturgeon. There will be no effects on reproduction. The proposed action is not likely to reduce distribution, because the action will not impede South Atlantic DPS Atlantic sturgeon from accessing any seasonal aggregation areas, including foraging, spawning, or overwintering grounds. Any consequences to distribution will be minor and temporary and limited to the temporary avoidance of areas with increased noise during pile driving.

Based on the information provided above, the proposed action will not appreciably reduce the likelihood of survival of the South Atlantic DPS (*i.e.*, it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment). The action will not affect the South Atlantic DPS Atlantic sturgeon in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, and it will not result in consequences to the environment which would prevent Atlantic sturgeon from completing their entire life cycle or completing essential behaviors including reproducing, foraging and sheltering. This is the case because: (1) the proposed action will not result in any mortality and associated potential future reproduction; (2) the proposed action will not change the status or trends of the species as a whole; (3) there will be no effect on the levels of genetic heterogeneity in the population; (4) the action will have only a minor and temporary consequence on the distribution of South Atlantic DPS Atlantic sturgeon in the action area and no consequence on the distribution of the species throughout its range; and, (5) the action will have only an insignificant effect on individual foraging or sheltering South Atlantic DPS Atlantic sturgeon.

In rare instances, an action that does not appreciably reduce the likelihood of a species' survival might appreciably reduce its likelihood of recovery. As explained above, we have determined that the proposed action will not appreciably reduce the likelihood that the South Atlantic DPS of Atlantic sturgeon will survive in the wild, which includes consideration of recovery potential.

Here, we consider whether the action will appreciably reduce the likelihood of recovery from the perspective of ESA Section 4. As noted above, recovery is defined as “Improvement in the status of listed species to the point at which listing [as threatened or endangered] is no longer appropriate under the criteria set out in Section 4(a)(1) of the Act.” . Thus, we have considered whether the proposed action will appreciably reduce the likelihood that South Atlantic DPS Atlantic sturgeon can rebuild to a point where the South Atlantic DPS of Atlantic sturgeon can rebuild to a point where listing of the South Atlantic DPS of Atlantic sturgeon as threatened or endangered is no longer appropriate.

No Recovery Plan for the South Atlantic DPS has been published. The Recovery Plan will outline the steps necessary for recovery and the demographic criteria, which once attained would allow the species to be delisted. In January 2018, we published a Recovery Outline for the five DPSs of Atlantic sturgeon (NMFS 2018). This outline is meant to serve as an interim guidance document to direct recovery efforts, including recovery planning, until a full recovery plan is developed and approved. The outline provides a preliminary strategy for recovery of the species. We know that in general, to recover, a listed species must have a sustained positive trend of increasing population over time. To allow that to happen for sturgeon, individuals must have access to enough habitat in suitable condition for foraging, resting and spawning. Conditions must be suitable for the successful development of early life stages. Mortality rates must be low enough to allow for recruitment to all age classes so that successful spawning can continue over time and over generations. There must be enough suitable habitat for spawning, foraging, resting, and migrations of all individuals. For South Atlantic DPS Atlantic sturgeon, habitat conditions must be suitable both in the natal river and in other rivers and estuaries where foraging by subadults and adults will occur and in the ocean where subadults and adults migrate, overwinter and forage. Habitat connectivity must also be maintained so that individuals can migrate between important habitats without delays that impact their fitness. As described in the vision statement in the Recovery Outline, subpopulations of all five Atlantic sturgeon DPSs must be present across the historical range. These subpopulations must be of sufficient size and genetic diversity to support successful reproduction and recovery from mortality events. The recruitment of juveniles to the sub-adult and adult life stages must also increase and that increased recruitment must be maintained over many years. Recovery of these DPSs will require conservation of the riverine and marine habitats used for spawning, development, foraging, and growth by abating threats to ensure a high probability of survival into the future. Here, we consider whether this proposed action will reduce the South Atlantic DPS likelihood of recovery.

This action will not change the status or trend of the South Atlantic DPS. The proposed action will not affect the distribution of Atlantic sturgeon across the historical range. The proposed action will not result in mortality or reduction in future reproductive output beyond what was considered in the *Environmental Baseline* and will not impair the species’ resiliency, genetic diversity, recruitment, or year class strength. The proposed action will have only insignificant effects on habitat and forage and will not impact habitat in a way that makes additional growth of the population less likely, that is, it will not reduce the habitat’s carrying capacity. This is because impacts to forage will be insignificant or extremely unlikely, and the area that sturgeon may avoid is small. Any avoidance will be temporary and limited to the period of time when pile driving or UXO detonation is occurring. For these reasons, the action will not reduce the likelihood that the South Atlantic DPS can recover. Therefore, the proposed action will not appreciably reduce the likelihood that the South Atlantic DPS of Atlantic sturgeon can be brought to the point at which they are no longer listed as threatened; that is, the proposed action will not appreciably reduce the likelihood of recovery of the South Atlantic DPS.

Based on the analysis presented herein, the effects of the proposed action are not likely to appreciably reduce the likelihood of both the survival and recovery of the South Atlantic DPS of Atlantic sturgeon. These conclusions were made in consideration of the status of the South Atlantic DPS of Atlantic sturgeon, the effects of the action, other stressors that individuals are exposed to within the action area as described in the *Environmental Baseline* and *Cumulative Effects*, and any anticipated effects of climate change.

9.2 Marine Mammals

Our effects analysis determined that pile driving is likely to adversely affect ESA-listed marine mammals in the action area and cause temporary threshold shift (TTS), behavioral response, and stress in a small number of individual North Atlantic right, fin, sei, and sperm whales. Pile driving is also likely to result in permanent threshold shift (PTS; auditory injury) in seven fin whales. Animals exposed to sufficiently intense sound exhibit an increased hearing threshold (i.e., poorer sensitivity) for some period of time following exposure; this is called a noise-induced threshold shift (TS). The magnitude of TS normally decreases over time following cessation of the noise exposure, TS that eventually returns to zero (i.e., the threshold returns to the pre-exposure value), is called TTS (Southall et al. 2008). TTS represents primarily tissue fatigue and is reversible (Southall et al., 2008). In addition, other investigators have suggested that TTS is within the normal bounds of physiological variability and tolerance and does not represent physical injury (*e.g.*, Ward, 1997). Therefore, NMFS does not consider TTS to constitute auditory injury.

No non-auditory injury, serious injury of any kind, or mortality is anticipated. We determined that exposure to other project noise will have effects that are insignificant or are extremely unlikely to occur. We also determined that effects to habitat and prey are also insignificant or extremely unlikely to occur and concluded that with the incorporation of vessel strike risk reduction measures that are part of the proposed action, strike of an ESA listed whale by a project vessel is extremely unlikely to occur and that entanglement or capture in fisheries surveys is extremely unlikely to occur. In this section, we discuss the likely consequences of these effects to the individual whales that have been exposed, the populations those individuals represent, and the species those populations comprise.

Our analyses identified the likely effects of the SouthCoast project, which requires authorizations from a number of federal agencies as described in Section 3 *Description of the Proposed Actions* of this Opinion, on the ESA-listed individuals that will be exposed to these actions. We measure effects to individuals of endangered or threatened marine mammals using changes in the individual's "fitness" or the individual's growth, survival, annual reproductive success, and lifetime reproductive success. When we do not expect listed marine mammals exposed to an action's effects to experience reductions in fitness, we would not expect the action to impact that animal's health or future reproductive success. Therefore, we would not expect adverse consequences on the overall reproduction, abundance, or distribution of the populations those individuals represent or the species those populations comprise. As a result, if we conclude that listed animals are not likely to experience reductions in their fitness, we would conclude our assessment. If, however, we conclude that listed animals are likely to experience reductions in their fitness, we would assess the consequences of those fitness reductions for the population or populations the individuals in an action area represent.

As documented in Section 7 *Effects of the Action* of this Opinion, the adverse effects anticipated on North Atlantic right, fin, sei, and sperm whales resulting from the proposed action are from sounds produced during pile driving in the action area. While this Opinion relies on the best available scientific and commercial information, our analysis and conclusions include uncertainty about the basic hearing capabilities of some marine mammals; how these animals use sounds as environmental cues; how they perceive acoustic features of their environment; the importance of sound to the normal behavioral and social ecology of species; the mechanisms by which human-generated sounds affect the behavior and physiology (including the non-auditory physiology) of exposed individuals; and the circumstances that could produce outcomes that have adverse consequences for individuals and populations of exposed species. Based on the best available information, we expect most exposures and potential responses of ESA-listed cetaceans to acoustic stressors associated with the SouthCoast project to have little effect on the exposed animals. As is evident from the available literature cited herein, responses are expected to be short-term, with the animal returning to normal behavior patterns shortly after the exposure is over (e.g., Goldbogen et al. 2013a; Silve et al. 2015). However, Southall et al. (2016) suggested that even minor, sub-lethal behavioral changes may still have significant energetic and physiological consequences given sustained or repeated exposure. We do not expect such sustained or repeated exposure of any individuals in this case.

9.2.1 North Atlantic Right Whales

As described in the *Status of the Species*, the endangered North Atlantic right whale is currently in decline in the western North Atlantic (Pace et al. 2017b; Pace et al. 2021) and experiencing an unusual mortality event (Daoust et al. 2017). Linden (2023) updated the population size estimate of North Atlantic right whales (at the beginning of 2022 using the most recent year of available sightings data (collected through December 2022). The estimated population size in 2022 was 356 whales, with a 95% credible interval ranging from 346 to 363 (Linden 2023). Linden 2023 uses more recent data than the most recent final Stock Assessment Report (Hayes et al. 2023), which notes an estimated population size as of November 30, 2020 for non-calf North Atlantic right whales of 338 (95% credible interval 325-350). The draft 2023 SAR (Hayes et al. 2023 DRAFT) identified an estimated population size as of August 30, 2022 of 340 with a 95% credible interval of 333-348. Linden 2024 (NOAA Tech Memo NMFS-NE-324, October 2024) updates the population size estimate for the most recent year of available sightings data. Using an established capture-recapture framework (Pace et al. 2017) and a new birth-integration approach (Linden 2024, preprint[61]), the estimated median population size at the start of 2023 was 372 whales, with a 95% credible interval ranging from 360 to 383. Linden notes that the sharp decrease observed from 2015-2020 appears to have slowed, though the right whale population continues to experience annual mortalities above recovery thresholds. This compares to an

[61] Linden DW. 2024. Using known births to account for delayed marking in population estimation of North Atlantic right whales. bioRxiv. https://doi.org/10.1101/2024.10.11.617830; last accessed November 2, 2024

estimate of the total North Atlantic right whale population size pre-whaling of between 9,075 and 21,328 (Hayes et al. 2023).

Modeling indicates that low female survival, a male-biased sex ratio, and low calving success are contributing to the population's current decline (Pace et al. 2017b). The species has low genetic diversity, as would be expected based on its low abundance, and the species' resilience to future perturbations (i.e., its ability to recover from declines in numbers or reproduction) is expected to be very low (Hayes et al. 2018). Vessel strikes and entanglement of right whales in U.S. and Canadian waters continue to occur and are considered the primary threats to the species (NMFS 2022, Runge et al. 2023, Hayes et al. 2023, Right Whale UME Data). Entanglement in fishing gear appears to have had substantial health and energetic costs that affect both survival and reproduction of right whales (van der Hoop et al. 2017a). Due to the declining status of North Atlantic right whales, the resilience of this population to stressors that would impact the distribution, abundance, and reproductive potential of the population is low. As described in the most recent 5-year Review (NMFS 2022), during the 2017-2022 period, right whale calving rates remained below average and overall body condition of the population has worsened (citing: Christiansen et al. 2020; Corkeron et al. 2018; Fortune et al. 2021; Moore et al. 2021; Stewart et al. 2021). At the same time, habitat important to North Atlantic right whales has changed in response to an oceanographic regime shift that has altered prey availability, which will likely continue to fluctuate as a result of climate change (NMFS 2022, citing: Gavrilchuck et al. 2020; Gavrilchuck et al. 2021; Lehoux et al. 2020; Meyer-Gutbrod et al. 2021; Record et al. 2019; Sorochan et al. 2019; Sorochan et al. 2021a). North Atlantic right whales are considered to be at a high demographic risk because of rapid population decline, habitat destruction, and continuing threats to recovery (NMFS 2022). The species faces a high risk of extinction and the population size is small enough for the death of any individuals to have measurable effects in the projections on its population status, trend, and dynamics. We note here that the proposed action is not expected to result in any injury or mortality of any North Atlantic right whale.

As described in the *Environmental Baseline* and *Status of the Species* sections, ongoing effects in the action area (e.g., global climate change, decreased prey abundance, vessel strikes, and entanglements) have contributed to concern for the species' persistence. Sublethal effects from entanglement affect the health of affected individuals and affect calving rates which impacts abundance and reproductive rates. Entanglement in fishing gear and vessel strikes are currently understood to be the most significant threats to the species and, as described in the *Environmental Baseline* may occur in the action area over the life of the proposed action. As noted in the *Cumulative Effects* section of this Opinion, we have not identified any cumulative effects different than those considered in the *Status of the Species* and *Environmental Baseline* sections of this Opinion, inclusive of how those activities may contribute to climate change. As described in Section 7.10, climate change is expected to negatively affect right whales throughout their range, including in the action area, over the life of this project; however, we have not identified any different or exacerbated effects of the action in the context of anticipated climate change.

Summary of Effects of the Proposed Actions

As addressed in Section 7 *Effects of the Action* of this Opinion, we find that the proposed action will result in adverse effects to some right whales that we have determined would be consistent with NMFS interim definition of harassment. This includes: 109 right whales exposed to pile driving noise during the installation of 149 foundations (noting that this is 109 exposures and may involve fewer individuals if a single individual is exposed to pile driving noise in multiple construction seasons); 28 right whales exposed to detonation of up to 10 UXO/MECs; and 44 right whales (average of one/year) experiencing significant disruption to feeding patterns due to exposure to hydrodynamic wakes from project foundations.

The distribution of right whales overlaps with some parts of the vessel transit routes that will be used through the 43 to 47-year life of the project. A number of measures designed to reduce the risk of vessel strike, including deploying lookouts and traveling at reduced speeds in areas where right whales are most likely to occur, as well as the use of PAM to enhance detection of right whales are part of the proposed action. As explained in Section 7.2, we have determined that strike of a right whale by a project vessel is extremely unlikely to occur. As such, vessel strike of a right whale and any associated injury or mortality is not an expected outcome of the SouthCoast project.

Based on the type of survey gear that will be deployed, we concluded that all effects to right whales from the surveys of fishery resources planned by SouthCoast and considered as part of the proposed action will be insignificant or discountable. We note that the commitment to use of ropeless/on-demand technology for the trap/pot survey, as described in Section 3 *Description of the Proposed Action* of this Opinion, is an important consideration in this determination. We have concluded that capture or entanglement of a right whale and any associated injury or mortality is not an expected outcome of the SouthCoast project.

As explained in Section 7.1, the effects of exposure to WTG operational noise and noise associated with other project activities (e.g., HRG surveys, vessels) are expected to be insignificant or discountable. As right whales do not echolocate, there is no potential for noise or other project effects to affect echolocation. As described in Section 7.1, the area around operating WTGs where operational noise may be above ambient noise is expected to be very small (50 -100 m or less); we determined that effects to right whale behavior from any exposure to operational noise would be insignificant. For HRG surveys, the best available data (Crocker and Fratantonio 2016) indicates that the area with noise above the level that would be disturbing to right whales is very small (no more than 200 m from the sound source). With the incorporation of the clearance and shutdown measures, we determined that exposure to noise that would be expected to result in a behavioral reaction (i.e., swimming away from the source), is extremely unlikely to occur. We also considered that in the extremely unlikely event that a right whale was exposed to noise from any HRG survey sources, effects would be insignificant given that exposure would be limited to only a few seconds, would not be expected to cause hearing, and any behavioral reaction would be limited to a very brief reaction which at most would be expected to swimming less than 200 m to avoid the noise.

A number of measures that are part of the proposed action, including a seasonal restriction on pile driving, requirements to use noise attenuation devices, minimum visibility requirements, and clearance and shutdown measures during pile driving monitored by PSOs on multiple platforms, reduce the potential for exposure of right whales to pile driving noise (impact and for Project 2, impact and vibratory). Similarly, measures that will be in place for all of the up to 10 UXO detonations, including time of year restrictions, requirements to use noise attenuation devices, minimum visibility requirements, and clearance measures that include aerial surveys of the clearance zone, reduce the potential for exposure of right whales to UXO detonations. With these measures in place, we do not anticipate the exposure of any right whales to noise that could result in PTS (auditory injury), other injury, or mortality. However, even with these minimization measures in place, we expect 109 North Atlantic right whales to experience TTS and/or temporary behavioral disturbance (with aversion/avoidance behavior lasting for the period the animal is exposed to the pile driving noise, up to 12 hours on a given day), and associated temporary physiological stress during the construction period due to exposure to pile driving noise. We also expect no more than 28 right whales to experience TTS as a result of exposure to noise from UXO detonation. We explain in Section 7.1 that these effects meet NMFS interim definition of harassment. While TTS, and any resulting impacts on behavior will occur for up to a week, given the very short duration of exposure to noise from UXO detonation (one second), any avoidance or aversion behavior would be limited to that short period. Disruptions to behavior resulting from TTS will end after TTS is resolved (within a week). As explained in the *Effects of the Action* section, all of these impacts, including TTS, are expected to be temporary; behaviors disrupted by avoidance/aversion behaviors resulting from exposure to pile driving or UXO are expected to resume quickly after the noise ends (see Goldbogen et al. 2013a; Melcon et al. 2012). Any TTS will resolve within a week of exposure (that is, hearing sensitivity will return to normal within one week of exposure) and is not expected to result in actual injury or affect the longterm health of any whale or its ability to migrate, forage, breed, or calve (Southall et al. 2008).

As explained in Section 7.1, we have also considered whether TTS, masking, or avoidance behaviors experienced by the 137 right whales exposed to noise that is expected to cause TTS or behavioral disturbance (consistent with the thresholds identified in NMFS 2018 and NMFS 2024) would be likely to increase the risk of vessel strike or entanglement in fishing gear. We would not expect the TTS to span the entire communication or hearing range of right whales given the frequencies produced by pile driving do not span entire hearing ranges for right whales. Additionally, though the frequency range of TTS that right whales might sustain would overlap with some of the frequency ranges of their vocalization types, the frequency range of TTS from SouthCoast's pile driving activities would not span the entire frequency range of one vocalization type, much less span all types of vocalizations or other critical auditory cues for any given species. As such, any effects of TTS on the ability of a right whale to communicate with other right whales or to detect audio cues to the extent they rely on audio cues to avoid vessels or other threats are expected to be minor and limited only to the less than a week-long period when we expect TTS to persist. To the extent that right whales may rely on acoustic cues to avoid threats, including vessel strikes and entanglements, TTS or masking may increase risk; however, these risks are lowered even further by the short duration of TTS (resolving within a week) and masking (limited only to the time that the whale is exposed to the pile driving noise, which would not exceed 12 hours considering the maximum duration of pile driving in a single day). In addition, as explained in Section 7.1, we do not expect that avoidance of pile driving noise would result in right whales moving to areas with higher risk of vessel strike or entanglement in fishing gear; vessel strike or entanglement in fishing gear as a result of exposure to pile driving noise is not an expected outcome of exposure to any project noise, including pile driving and UXO/MEC detonations. This determination was made in consideration of the distance a whale is expected to travel to avoid disturbing levels of noise, the duration of exposure, and the distribution of vessel traffic and fishing activity in the WDA and surrounding waters.

We have considered if pile driving noise may mask right whale calls and could have effects on mother-calf communication and behavior. As noted in Section 7.1, presence of mother-calf pairs is unlikely in the WDA when pile driving would occur. However, even if a mother-calf pair was exposed to pile driving noise, we do not anticipate that masking would result in fitness consequences given their short-term nature. As noted in Section 7.1, when calves leave the foraging grounds off the coast of the southeastern U.S. at around four months of age, they are expected to be more robust and less susceptible to a missed or delayed nursing opportunity. Any masking of communications or any delays in nursing due to swimming away from the pile driving noise would only last for the duration of the exposure to pile driving noise; not exceeding 12 hours of pile driving on a given day. This temporary disruption is not expected to have any health consequences to the calf or mother due to its short-term duration and the ability to resume normal behaviors (in this case, nursing) as soon as they are out of range of the disturbance.

As explained in Section 7.1, the duration of exposure to UXO detonations will be one second; for pile driving it could be up to 12 hours per day, with duration dependent on where the animal is when pile driving begins and how quickly it moves away from sound source. While exposure is not expected to exceed the period of active pile driving in a day (four to 12 hours), it is far more likely that any exposure and associated aversion/avoidance behavior would be for a significantly shorter period of time as a right whale would be several kms away from the pile when pile driving started and is expected to swim away from the disturbing noise. Given the extremely short duration of UXO detonation (one second), we do not expect exposure to result in avoidance or displacement.

An animal exhibiting the expected avoidance response to pile driving noise would experience a cost in terms of the energy associated with traveling away from the acoustic source. Studies of marine mammal avoidance of sonar, which like pile driving is an impulsive sound source, demonstrate clear, strong, and pronounced behavioral changes, including sustained avoidance with associated energetic swimming and cessation of feeding behavior (Southall et al. 2016) suggesting that it is reasonable to assume that a whale exposed to noise above the behavioral disruption threshold (160 dB re 1uPa RMS for non-explosive impulsive or intermittent noise and 120 dB re 1uPa RMS for continuous noise sources, NMFS 2018) would take a direct path to get outside of the noisy area.

As explained in Section 7.1, we have determined that project noise will not have adverse effects on right whale prey; that is, we do not expect any reductions in prey abundance or availability or changes in distribution due to pile driving, UXO detonation, or any other project noise. As explained in Section 7.1, the time of year restrictions for pile driving (considering the lease area as a whole and the right whale enhanced mitigation area) was designed such that pile driving would only occur during the time of year when density of right whales was lowest and that avoids the winter and spring foraging period. During the time of year when pile driving will occur, right whale presence in the lease area is intermittent and occasional and any feeding is similarly intermittent and occasional. In the event that prey patches are present to support foraging during the time of year when pile driving occurs, there is the potential for a right whale to be engaged in foraging behavior that would be disrupted by pile driving. However, this would be limited to a one-time occurrence and would not be repetitive or chronic. Based on the best available information that indicates whales resume normal behavior quickly after the cessation of sound exposure (e.g., Goldbogen et al. 2013a; Melcon et al. 2012), we anticipate that the up to 109 right whales exposed to noise during pile driving that would be expected to disrupt behavioral patterns will return to normal behavioral patterns, including any feeding, after the exposure ends. As such, even if a right whale exposed to pile driving noise was foraging, this disruption would be short term and impact no more than one foraging event on a single day and is not expected to have any longterm health consequences. Given this would be a one time occurrence outside of the primary winter/spring foraging period, we reach this same conclusion even when considering reproductive females and right whales that are injured, including entangled animals.

There would likely be an energetic cost associated with any temporary displacement, disruption to migratory route, and/or disruption of a single foraging event as a result of exposure to pile driving noise. However, because these will not occur over long durations and foraging will not be disrupted over subsequent days, the effects of an increase in energy associated with disruption or displacement due to exposure to pile driving noise to be consequential to the animal over the long term (see Southall et al. 2008). The energetic consequences of the evasive behavior and delay in resting or foraging for a few hours on a single day are not expected to affect any individual's ability to successfully obtain enough food to maintain their health, or impact the ability of any individual to make seasonal migrations or participate in future breeding or calving. Stress responses are also anticipated to occur as a result of noise exposure and the accompanying behavioral response. The available literature suggests these acoustically induced stress responses will be of short duration (similar to the duration of exposure), and not result in a chronic increase of stress that could result in physiological consequences to the animal (Southall et al. 2008). Given the short period of time during which elevated noise will be experienced (4 to 12 hours per day), with subsequent exposures in a single construction season not expected to occur, we do not anticipate long duration exposures to occur, and we do not anticipate the associated stress of exposure to result in long-term effects to affected individuals. Given the short duration of the exposure and associated response, we reach this same conclusion even when considering reproductive females and right whales that are injured, including entangled animals.

We explain in Section 7.1, that for all right whales exposed to pile driving noise above the behavioral disturbance threshold or above the TTS threshold for UXO detonations (total of 137), these effects will meet NMFS interim definition of harassment but not harm. In this case, the likelihood of injury is created by the combination of aversion/avoidance behavior, change in hearing sensitivity (TTS), masking, disruptions to resting, migrating, and feeding, increased stress and energetic consequences, and impacts on ability to detect and avoid threats that, together, are a significant disruption of normal behaviors. This disruption will persist for the duration of TTS and is not expected to last longer than 1 week or to be repeated in a single year (but may be repeated in subsequent construction years). These consequences will be greatest for individuals that are already compromised due to existing injuries or entanglements and reproductive females, which as described above, are expected to have depleted energy budgets and energy reserves. As explained in Section 7.1, we do not expect that the individuals that experience this harassment would experience harm as we do not expect any actual injury to occur. As described previously, information is not available to conduct a quantitative analysis to determine the likely fitness consequences of these exposures and associated responses because we do not have information from wild cetaceans that links short-term behavioral responses to vital rates and animal health. Nearly all studies and experts agree that infrequent exposures of a single day or less are unlikely to impact an individual's overall energy budget (Farmer et al. 2018; Harris et al. 2017b; King et al. 2015b; NAS 2017; New et al. 2014; Southall et al. 2008; Villegas-Amtmann et al. 2015). Based on best available information, we expect this to be the case for North Atlantic right whales exposed to acoustic stressors associated with this project even for animals that may already be in a stressed or compromised state due to factors unrelated to the SouthCoast project; therefore, while we expect behavioral disruption to be substantial during the period of exposure and response creating the likelihood of injury, we do not expect this harassment to reduce the likelihood of successful migration, breeding, calving, or nursing or otherwise result in any actual injury. Thus, while we expect the annoyance or disturbance from exposure to pile driving noise and UXO detonations to be a significant disruption of normal behavioral patterns, and create the likelihood of injury, we do not expect injury or mortality to actually occur: the effects to right whales resulting from exposure to these noise sources therefore do not meet the ESA definition of "harm."

In Section 7.3 of this Opinion, we considered the potential for the loss of right whale prey due to impingement or entrainment if suction bucket foundations are installed during Project 2. As explained there, we determined that the potential loss of prey is likely to have insignificant effects on right whales. This is because the loss is not expected to be detectable compared to natural variability in the abundance and distribution of prey, would occur at times of year when feeding behavior is limited and density of right whales is lowest in the lease area (which reduces the potential for exposure), and that any loss of prey would be a one-time event. In Section 7.4, we consider effects to right whales following installation of project structures, including impacts on habitat and prey. We expect that the operation of the Project 1 HVDC in compliance with EPA's draft NPDES permit, which involves the withdrawal of cooling water, will result in the loss of right whale prey on a continuous basis over its operation. However, we determined that given the small amount of prey that will be affected and that the loss is not expected to be detectable compared to natural variability in the abundance and distribution of prey, and that it is unlikely to affect the foraging behavior of any right whales, effects to right whales will be insignificant. We reach these same conclusions even when considering the loss of prey resulting from both the use of suction bucket foundations and the operation of the HVDC.

In Section 7.4, we determined that the disruptions to prey that we expect to result from the hydrodynamic wakes resulting from the installation and presence of the up to 149 project foundations are likely to affect the efficiency of right whales foraging in the areas affected by the wakes, which will extend up to 1,000 m from each of the 149 foundations and occur continuously over the approximately 44 years that project foundations will be in place. We explain in Section 7.4, that for right whales with pre-existing injuries, including entanglements, and for reproductive females, these effects will meet NMFS interim definition of harassment but not harm. In this case, the likelihood of injury is created by the change in feeding that, when added to the already compromised state of injured or entangled individuals and reproductive females, which as described above, are expected to have depleted energy budgets and energy reserves, either further depletes the animal's energy reserves or fails to maintain or increase those energy reserves. This in turn affects whether an injured or entangled individual has the energetic reserves to resist or recover from existing or new injuries or physiological impacts that could affect the individual's growth, health, and/or ability to survive. For reproductive females, this affects the ability of the female to recover or rebuild energy reserves to support future pregnancies and may make the individual more vulnerable and less able to recover from future injury or physiological stress that could affect the individual's health and reproductive success. As explained, we expect that up to 44 individual right whales would experience this harassment over the life of the project, at a rate of approximately 1 individual per year. As established in Section 7.4, we find that there would be significant disruptions to feeding behaviors (and not resting, migrating, socializing, or mating). We do not expect that the individuals that experience this harassment would experience harm as we do not expect any actual injury to occur. That is, while the substantial disruption to foraging behavior and the resulting effects on an animal's energy budget will affect its resiliency (i.e., as established above, its ability to recover from and survive a physical injury or entanglement while supporting metabolic function and building or rebuilding lipid stores/energy reserves and for reproductive females, to support metabolic function while building sufficient energy reserves to maintain a calving interval, support a pregnancy, and nurse a calf), we do not expect foraging to be impaired to the extent that there will be an effect on the animal's overall energy budget or energy reserves in a way that would actually compromise its ability to successfully obtain enough food such that it would not be able to make seasonal migrations or participate successfully in breeding, calving, or nursing which we would consider to be "injury" in the context of the ESA definition of harm. Thus, while we expect the disturbance of foraging to be a significant disruption of normal behavioral (feeding) patterns, and create the likelihood of injury, we do not expect injury or mortality to actually occur: the effects to right whales from effects to foraging behavior associated with the hydrodynamic wakes and resulting impacts on the distribution and aggregation of zooplankton prey therefore do not meet the ESA definition of "harm."

Consideration of Effects on Survival and Recovery

Considering all of the anticipated effects of the construction, operations and maintenance, and decommissioning of the SouthCoast project, which will occur over a 43 to 47 year period, the only adverse effects to North Atlantic right whales expected to result from the SouthCoast project are harassment as quantified above. We do not expect any effects that would meet NMFS definition of harm under the ESA. We do not expect any actual injury (auditory or other), serious injury, or mortality due to exposure to any aspect of the proposed action during the construction, operations, or decommissioning phases of the project. Death of a right whale is not an expected outcome of the SouthCoast project. We also do not expect effects that would increase the calving interval or otherwise reduce the number of calves that are produced or the success of nursing or other health outcomes that would affect the successful weaning of a calf. We do not expect mating to be disrupted or prevented. For these reasons, we do not expect the SouthCoast project to result in any reduction in the numbers or reproduction of North Atlantic right whales. There will be no effects on the range-wide distribution of right whales; any effects to distribution will be limited to short-term alterations to normal movements by individuals to avoid disturbing levels of noise. Based on the information provided here, the proposed action will not appreciably reduce the likelihood of survival of the North Atlantic right whale by reducing the reproduction, numbers, or distribution of the species as we do not anticipate any reduction in reproduction, numbers, or distribution of right whales (*i.e.*, it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment).

The proposed action is not likely to affect the recovery potential of North Atlantic right whales (i.e. affect the likelihood that North Atlantic right whales can rebuild to a point where it is downlisted and ultimately listing is no longer appropriate). In making this determination we have considered generalized needs for species recovery and the goals and criteria identified in the 2005 Recovery Plan for North Atlantic right whales (NMFS 2005). As described in the Recovery Plan, the ultimate goal of the recovery plan is to promote the recovery of North Atlantic right whales to a level sufficient to warrant their removal from the List of Endangered and Threatened Wildlife and Plants under the ESA; the intermediate goal is to reclassify the species from endangered to threatened. We know that in general, to recover, a listed species must have a sustained positive trend of increasing population over time. In general, mortality rates must be low enough to allow for recruitment to all age classes so that successful calving can continue over time and over generations. The 2005 Recovery Plan (NMFS 2005) states that North Atlantic right whales may be considered for reclassifying to threatened when all of the following have been met: 1) The population ecology (range, distribution, age structure, and gender ratios, etc.) and vital rates (age-specific survival, age-specific reproduction, and lifetime reproductive success) of right whales are indicative of an increasing population; 2) The population has increased for a period of 35 years at an average rate of increase equal to or greater than 2% per year; 3) None of the known threats to Northern right whales (summarized in the five listing factors) are known to limit the population's growth rate; and, 4) Given current and projected threats and environmental conditions, the right whale population has no more than a 1% chance of quasi-extinction in 100 years.

The proposed action will not result in any condition that impacts the time it will take to reach these goals or the likelihood that these goals will be met. This is because the proposed action will not result in the population ecology or vital rates that would affect the species' population trend; we reach this conclusion because the proposed action will not affect the range, distribution, age structure, gender ratio, age-specific survival, age-specific reproduction, or lifetime reproductive success of any individual. This is because the proposed action is not expected to result in the mortality of any individual or result in the increase of calving interval for any interval or otherwise result in a reduction in successful calving. For these same reasons, the proposed action will not affect the potential for the population to increase and therefore it would not affect the potential for the population to increase at a rate equal to or greater than 2% a year for 35 years. The proposed action will not affect how any of the known threats, particularly vessel strikes and entanglement, will limit the population's growth rate; this is because the proposed action is not expected to result in an increase of the number of right whales that are struck by vessels or entangled in fishing gear or actually reduce their ability to survive a vessel strike or entanglement that occurs from sources not related to the proposed action. As the proposed action will not affect the trend of the species or prevent or delay it from achieving an increasing population or otherwise affect its growth rate, we find that it will not affect the chance of quasi-extinction. For these reasons, we conclude that the proposed action will not appreciably reduce the likelihood of recovery of North Atlantic right whales.

Conclusion of Analysis

For the reasons presented herein, the effects of the proposed action are not likely to appreciably reduce the likelihood of both the survival and recovery of North Atlantic right whales in the wild. Therefore, by definition, the proposed action is not likely to jeopardize the continued existence of the North Atlantic right whale. These conclusions were made in consideration of the best available scientific information as cited herein, the endangered status of North Atlantic right whales, the effects of the action, other stressors that individuals are exposed to within the action area as described in the *Environmental Baseline* and *Cumulative Effects* section of this Opinion, and any anticipated effects of climate change on the abundance, reproduction, and distribution of right whales in the action area.

9.2.2 Fin Whales

The best available current abundance estimate for fin whales in the North Atlantic stock is 6,802 (CV=0.24), sum of the 2016 NOAA shipboard and aerial surveys and the 2016 NEFSC and Department of Fisheries and Oceans Canada (DFO) surveys; the minimum population estimate for the western North Atlantic fin whale is 5,573 (Hayes et al. 2021). Fin whales in the North Atlantic compromise one of the three to seven stocks in the North Atlantic. According to the latest NMFS stock assessment report for fin whales in the Western North Atlantic, information is not available to conduct a trend analysis for this population (Hayes et al. 2021). Rangewide, there are over 100,000 fin whales occurring primarily in the North Atlantic Ocean, North Pacific Ocean, and Southern Hemisphere.

Entanglement in fishing gear and vessel strikes as described in the *Environmental Baseline* may occur in the action area over the life of the proposed action. As noted in the Cumulative Effects section of this Opinion, we have not identified any cumulative effects different from those considered in the *Status of the Species* and *Environmental Baseline* sections of this Opinion, inclusive of how those activities may contribute to climate change. As described in Section 7.10, climate change may result in changes in the distribution or abundance of fin whales in the action area over the life of this project; however, we have not identified any different or exacerbated effects of the action in the context of anticipated climate change.

As explained in the Section 7.0 *Effects of the Action* of this Opinion, with the exception of 7 fin whales expected to experience PTS due to exposure to pile driving noise, the only adverse effects to fin whales expected to result from the SouthCoast project are temporary behavioral disturbance and/or temporary threshold shift (minor and temporary hearing impairment); we consider these adverse effects to occur at a level meeting NMFS's interim ESA definition of harassment. These adverse effects will be experienced by up to 569 individual fin whales as a result of exposure to noise from pile driving (520) or UXO detonation (49). No injury (auditory or other), serious injury or mortality is expected due to exposure to any aspect of the proposed action during the construction, operations, or decommissioning phases of the project.

The distribution of fin whales overlaps with some parts of the vessel transit routes that will be used through the 43 to 47-year life of the project. A number of measures designed to reduce the risk of vessel strike, including deploying lookouts and traveling at reduced speeds in areas where fin whales are most likely to occur, are part of the proposed action. As explained in Section 7.2, we have determined that strike of a fin whale by a project vessel is extremely unlikely to occur.

As such, vessel strike of a fin whale and any associated injury or mortality is not an expected outcome of the SouthCoast project.

Based on the type of survey gear that will be deployed, we determined that effects to fin whales from the surveys of fishery resources planned by SouthCoast and considered as part of the proposed action are extremely unlikely to occur. As such, capture or entanglement of a fin whale and any associated injury or mortality is not an expected outcome of the SouthCoast project.

As explained in Section 7.1, the effects of exposure to WTG operational noise and noise associated with other project activities (e.g., HRG surveys, vessels) are expected to be insignificant. We also determined that effects of construction, operation, and decommissioning, inclusive of project noise, will have insignificant effects on fin whale feeding behavior. As fin whales do not echolocate, there is no potential for noise or other project effects to affect echolocation. The area around operating WTGs where operational noise may be above ambient noise is expected to be very small (50 -100m or less) and any effects to fin whales from avoiding that very small area would be insignificant. For HRG surveys, the best available data (Crocker and Fratantonio 2016) indicates that the area with noise above the level that would be disturbing to fin whales is very small (no more than 200 m from the sound source). Given the small area, the shutdown and clearance requirements, and that we only expect a whale exposed to that noise to swim just far enough way to avoid it (less than 200 m), effects are insignificant.

A number of measures that are part of the proposed action, including a seasonal restriction on pile driving, requirements to use noise attenuation devices, minimum visibility requirements, and clearance and shutdown measures during pile driving monitored by PSOs on multiple platforms, reduce the potential for exposure of fin whales to pile driving noise. Similarly, measures that will be in place for any UXO detonations, including requirements to use noise attenuation devices, minimum visibility requirements, and clearance measures that include aerial surveys of the clearance zone, reduce the potential for exposure of fin whales to UXO detonations. However, even with these minimization measures in place, we expect up to 7 fin whales to experience PTS due to pile driving noise and up to 520 fin whales to experience TTS, temporary behavioral disturbance, and associated temporary physiological stress during the construction period due to exposure to pile driving noise. We also expect no more than 49 fin whales to experience TTS as a result of exposure to noise from UXO detonation. As explained in the *Effects of the Action* section, all of these impacts, including TTS, are expected to be temporary with normal behaviors resuming quickly after the noise ends (see Goldbogen et al. 2013a; Melcon et al. 2012). Any TTS will resolve within a week of exposure (that is, hearing sensitivity will return to normal within one week of exposure) and is not expected to affect the health of any whale or its ability to migrate, forage, breed, or calve (Southall et al. 2008).

PTS is permanent, meaning the effects of PTS last well beyond the duration of the proposed action and outside of the action area as animals migrate. As such, PTS has the potential to affect aspects of affected animal's life functions that do not overlap in time and space with the proposed action. As explained in Section 7.1, we expect that the up to 7 fin whales estimated to be exposed to pile driving noise above the auditory injury (PTS) threshold would experience slight PTS, *i.e.* minor long-term or permanent degradation of hearing capabilities within regions of hearing that align most completely with the energy produced by pile driving (*i.e.* the low-frequency region below 2 kHz), not severe hearing impairment. If hearing impairment occurs, it is most likely that the affected animal would lose a few decibels in its hearing sensitivity, which in most cases is not likely to meaningfully affect its ability to forage and communicate with conspecifics, much less impact reproduction or survival (87 FR 64868; October 26, 2022). No severe hearing impairment or serious injury is expected because of the received levels of noise anticipated and the short duration of exposure. The PTS anticipated is considered a minor auditory injury and as such, it constitutes take by harm under the ESA. The up to 7 fin whales that are harmed will also experience the physiological (i.e., stress) and behavioral effects described below for the animals that experience TTS. As discussed previously in Section 7.1, permanent hearing impairment has the potential to affect individual whale survival and reproduction, although data are not readily available to evaluate how permanent hearing threshold shifts directly relate to individual whale fitness. Our exposure and response analyses indicate that no more than 7 fin whales would experience PTS, but this PTS is expected to be minor. With this minor degree of PTS, we do not expect it to affect the individuals' overall health, reproductive capacity, or survival. The 7 individual fin whales could be less efficient at locating conspecifics or have decreased ability to detect threats at long distances, but these animals are still expected to be able to locate conspecifics to socialize and reproduce, and will still be able to detect threats with enough time to avoid injury. For this reason, we do not anticipate that the instances of PTS will result in changes in the number, distribution, or reproductive potential of fin whales in the North Atlantic.

Fin whales in the lease area are migrating, resting, and feeding. We expect behaviors disrupted by avoidance/aversion of pile driving noise to resume quickly after the noise ends (see Goldbogen et al. 2013a; Melcon et al. 2012). Any TTS will resolve within a week of exposure (that is, hearing sensitivity will return to normal within one week of exposure) and is not expected to affect the long-term health of any whale or its ability to migrate, forage, breed, or calve (Southall et al. 2008). We would not expect the TTS to span the entire communication or hearing range of fin whales given the frequencies produced by pile driving do not span entire hearing ranges for fin whales. Additionally, though the frequency range of TTS that fin whales might sustain would overlap with some of the frequency ranges of their vocalization types, the frequency range of TTS from exposure to noise from SouthCoast activities would not span the entire frequency range of one vocalization type, much less span all types of vocalizations or other critical auditory cues for any given species. Before the TTS resolves, individual fin whales could be less efficient at locating conspecifics or have decreased ability to detect threats at long distances, but these animals are still expected to be able to locate conspecifics to socialize and reproduce, and will still be able to detect threats with enough time to avoid injury, including vessel strike.

The risks of TTS or masking resulting in actual injury as a result of affects to communication or threat avoidance are lowered by the narrow frequency range effected and the short duration of TTS (resolving within a week) and masking (limited only to the time that the whale is exposed to the foundation installation noise, less than 12 hours). Also, as explained in Section 7.1, we do not expect that avoidance of pile driving noise would result in fin whales moving to areas with higher risk of vessel strike or entanglement in fishing gear; vessel strike or entanglement in fishing gear as a result of exposure to pile driving noise is not expected. This determination was made in consideration of the distance a whale is expected to travel to avoid disturbing levels of noise and the distribution of vessel traffic and fishing activity in the WDA and surrounding waters.

We have considered if pile driving noise may mask fin whale calls and could have effects on mother-calf communication and behavior. If a mother-calf pair was exposed to pile driving noise, we do not anticipate that masking would result in fitness consequences given their short-term nature. Any masking of communications or any delays in nursing due to swimming away from the pile driving noise would only last for the duration of the exposure to pile driving noise, which in all cases would not be expected to exceed the up to approximately 12 hours of pile driving that would occur in a single day. This temporary disruption is not expected to have any health consequences to the calf or mother due to its short-term duration and the ability to resume normal behaviors as soon as they are out of range of the disturbance.

Fin whales in the WDA are migrating and foraging. Based on the best available information that indicates whales resume normal behavior quickly after the cessation of sound exposure (e.g., Goldbogen et al. 2013a; Melcon et al. 2012), we anticipate that the up to 569 fin whales exposed to noise above the behavioral disturbance threshold will return to normal behavioral patterns after the exposure ends. As such, even if a fin whale exposed to pile driving noise or a UXO detonation was foraging, this disruption is only expected to disrupt foraging for up to 12 hours. The energetic consequences of missed or delayed foraging for a single 12-hour period are not expected to be significant for the affected animals.

As explained in Section 7.1, the duration of exposure to UXO detonations will be one second; for pile driving it could be up to 12 hours per day, with duration dependent on where the animal is when pile driving begins and how quickly it moves away from sound source. While exposure is not expected to exceed the period of active pile driving in a day (four to 12 hours), it is far more likely that any exposure and associated aversion/avoidance behavior would be for a significantly shorter period of time as a fin whale would be outside the clearance zone when pile driving started and is expected to swim away from the disturbing noise. Given the extremely short duration of UXO detonation (one second), we do not expect exposure to result in avoidance or displacement.

There would likely be an energetic cost associated with any temporary displacement or change in migratory route, but unless disruptions occur over long durations or over subsequent days, which we do not expect, we do not anticipate this movement to be consequential to the animal over the long term (see Southall et al. 2008). The energetic consequences of the evasive behavior and delay in resting are not expected to affect any individual's ability to successfully obtain enough food to maintain their health, or impact the ability of any individual to make seasonal migrations or participate in future breeding or calving. Stress responses are also anticipated with each of these instances of disruption. However, the available literature suggests these acoustically induced stress responses will be of short duration (similar to the duration of exposure), and not result in a chronic increase in stress that could result in physiological consequences to the animal (Southall et al. 2008). Given the short period of time during which individuals will be exposed to elevated noise, we do not anticipate long duration exposures to occur, and we do not anticipate the associated stress of exposure to result in significant costs to affected individuals**.**

As explained in Section 7.0 *Effects of the Action* of this Opinion, after independent review and analysis applying the NMFS ESA interim guidance definition of harassment, we determined that the adverse effects expected to result from the exposure of the 569 fin whales to noise below the acoustic injury (PTS) threshold but above the behavioral disturbance threshold meet NMFS interim ESA definition of harassment. The proposed action will result in the take by ESA harassment, but not harm, of 542 individual fin whales; the only injury anticipated is of the up to 7 fin whales that are expected to experience PTS due to exposure to pile driving noise above the acoustic injury (PTS) threshold. No other injury, and no harm, serious injury, or mortality is expected due to exposure to any aspect of the proposed action during the construction, operations, or decommissioning phases of the project.

Our analysis considered the overall number of exposures to acoustic stressors that are expected to result in harassment, inclusive of behavioral responses, TTS, and stress, the duration, and scope of the proposed activities expected to result in such impacts, the expected behavioral state of the animals at the time of exposure, and the expected condition of those animals. Instances of fin whale exposure to acoustic stressors are expected to be short-term, with the animal returning to its previous behavioral state shortly thereafter. As described previously, information is not available to conduct a quantitative analysis to determine the likely fitness consequences of these exposures and associated responses because we do not have information from wild cetaceans that links short-term behavioral responses to vital rates and animal health. Harris et al. (2017a) summarized the research efforts conducted to date that have attempted to understand the ways in which behavioral responses may result in long-term consequences to individuals and populations. Efforts have been made to try to quantify the potential consequences of such responses, and frameworks have been developed for this assessment (e.g., Population Consequences of Disturbance). However, models that have been developed to date to address this question require many input parameters and, for most species, there are insufficient data for parameterization (Harris et al. 2017a). Nearly all studies and experts agree that infrequent exposures of a single day or less are unlikely to impact an individual's overall energy budget (Farmer et al. 2018; Harris et al. 2017b; King et al. 2015b; NAS 2017; New et al. 2014; Southall et al. 2008; Villegas-Amtmann et al. 2015). Based on best available information, we expect this to be the case for fin whales exposed to acoustic stressors associated with this project even for animals that may already be in a stressed or compromised state due to factors unrelated to the SouthCoast project. Because we do not anticipate fitness consequences to individual fin whales to result from instances of TTS and behavioral disturbance due to acoustic stressors that we have determined meets the ESA definition of harassment but not harm, we do not expect reductions in overall reproduction, abundance, or distribution of the fin whale population in the North Atlantic or rangewide.

The proposed action will not result in any reduction in the abundance or reproduction of fin whales. Any effects to distribution will be limited to short-term alterations to normal movements by individuals to avoid disturbing levels of noise. There will be no change to the overall distribution of fin whales in the action area or throughout their range. Based on the information provided here, the proposed action will not appreciably reduce the likelihood of survival of the fin whale (*i.e.,* it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment).

The proposed action is not likely to affect the recovery potential of fin whales. In making this determination we have considered generalized needs for species recovery and the goals and criteria identified in the 2010 Recovery Plan for fin whales. We know that in general, to recover, a listed species must have a sustained positive trend of increasing population over time. In general, mortality rates must be low enough to allow for recruitment to all age classes so that successful calving can continue over time and over generations. The 2010 Recovery Plan for fin whales included two criteria for consideration for reclassifying the species from endangered to threatened:

> 1. Given current and projected threats and environmental conditions, the fin whale population in each ocean basin in which it occurs (North Atlantic, North Pacific and Southern Hemisphere) satisfies the risk analysis standard for threatened status (has no more than a 1% chance of extinction in 100 years) and has at least 500 mature, reproductive individuals (consisting of at least 250 mature females and at least 250 mature males) in each ocean basin. Mature is defined as the number of individuals known, estimated, or inferred to be capable of reproduction. Any factors or circumstances that are thought to substantially contribute to a real risk of extinction that cannot be incorporated into a Population Viability Analysis will be carefully considered before downlisting takes place; and,
>
> 2. None of the known threats to fin whales are known to limit the continued growth of populations. Specifically, the factors in 4(a)(l) of the ESA are being or have been addressed: A) the present or threatened destruction, modification or curtailment of a species' habitat or range; B) overutilization for commercial, recreational or educational purposes; C) disease or predation; D) the inadequacy of existing regulatory mechanisms; and E) other natural or manmade factors.

The proposed action will not result in any condition that impacts the time it will take to reach these goals or the likelihood that these goals will be met. This is because the proposed action will not affect the trend of the species or prevent or delay it from achieving an increasing population or otherwise affect the number of individuals or the species growth rate and will not affect the chance of extinction. The proposed action will not appreciably reduce the likelihood of recovery of fin whales.

The proposed action will not affect the abundance of fin whales; because no serious injury or mortality is anticipated, the project will not cause there to be fewer fin whales. The only effects to distribution of fin whales will be minor changes in the movements of the individuals exposed to pile driving noise or a UXO detonation; there will be no changes in the distribution of the species throughout the action area or throughout its range. The proposed action will have no effect on reproduction because it will not affect the health of any potential mothers or the potential for successful breeding or calving; the project will not cause any reduction in reproduction. As explained above, the proposed action will not affect the recovery potential of the species.

Based on this analysis, the effects of the proposed action are not likely to appreciably reduce the likelihood of both the survival and recovery of fin whales in the wild by reducing the reproduction, numbers, or distribution of that species. These conclusions were made in consideration of the endangered status of fin whales, the effects of the action, other stressors that individuals are exposed to within the action area as described in the *Environmental Baseline* and *Cumulative Effects*, and any anticipated effects of climate change on the abundance, reproduction, and distribution of fin whales in the action area.

9.2.3 Sei Whales

The average spring 2010–2013 abundance estimate of 6,292 (CV=1.015) is considered the best available for the Nova Scotia stock of sei whales because it was derived from surveys covering the largest proportion of the range (Halifax, Nova Scotia to Florida), during the season when they are the most prevalent in U.S. waters (in spring), using only recent data (2010–2013), and correcting aerial survey data for availability bias (Hayes et al. 2021). However, as described in Hayes et al. 2021 (the most recent stock assessment report), there is considerable uncertainty in this estimate and there are insufficient data to determine population trends for the Nova Scotia stock of sei whales. As described in the Status of the Species, the most recent abundance estimate we are aware of for sei whales is 25,000 individuals worldwide (Braham 1991). According to the latest NMFS stock assessment report for sei whales in the western North Atlantic, there are insufficient data to determine population trends for sei whales (Hayes et al. 2021). Across its range, it is estimated that there are over 50,000 sei whales. In the North Pacific, an abundance estimate for the entire North Pacific population of sei whales is not available. However, in the western North Pacific, it is estimated that there are 35,000 sei whales (Cooke 2018a). In the eastern North Pacific (considered east of longitude 180°), two stocks of sei whales occur in U.S. waters: Hawaii and Eastern North Pacific. Abundance estimates for the Hawaii stock are 391 sei whales (Nmin=204), and for Eastern North Pacific stock, 519 sei whales (Nmin=374) (Carretta et al. 2019a). In the Southern Hemisphere, recent abundance of sei whales is estimated at 9,800 to 12,000 whales.

Entanglement in fishing gear and vessel strikes as described in the *Environmental Baseline*, may occur in the action area over the life of the proposed action. As noted in the *Cumulative Effects* section of this Opinion, we have not identified any cumulative effects different than those considered in the *Status of the Species* and *Environmental Baseline* sections of this Opinion, inclusive of how those activities may contribute to climate change. As described in Section 7.10, climate change may result in changes in the distribution or abundance of sei whales in the action area over the life of this project; however, we have not identified any different or exacerbated effects of the action in the context of anticipated climate change.

As explained in the Section 7.0 *Effects of the Action* of this Opinion, the only adverse effects to sei whales expected to result from the SouthCoast project are temporary behavioral disturbance and/or temporary threshold shift (minor and temporary hearing impairment); these adverse effects meet NMFS interim ESA definition of harassment. These adverse effects will be experienced by up to 63individual sei whales as a result of exposure to noise from pile driving (47) or UXO detonation (16). No injury (auditory or other), serious injury, or mortality is expected due to exposure to any aspect of the proposed action during the construction, operations, or decommissioning phases of the project.

The distribution of sei whales overlaps with some parts of the vessel transit routes that will be used through the 43 to 47-year life of the project. A number of measures designed to reduce the risk of vessel strike, including deploying lookouts and traveling at reduced speeds in areas where sei whales are most likely to occur, are part of the proposed action. As explained in Section 7.2, we have determined that strike of a sei whale by a project vessel is extremely unlikely to occur. As such, vessel strike of a sei whale and any associated injury or mortality is not an expected outcome of the SouthCoast project.

Based on the type of survey gear that will be deployed, we do not expect any effects to sei whales from the surveys of fishery resources planned by SouthCoast and considered as part of the proposed action. As such, capture or entanglement of a sei whale and any associated injury or mortality is not an expected outcome of the SouthCoast project.

As explained in Section 7.1, the effects of exposure to WTG operational noise and noise associated with other project activities (e.g., HRG surveys, vessels) are expected to be insignificant. We also determined that effects of construction, operation, and decommissioning, inclusive of project noise, will have insignificant effects on sei whale prey. As sei whales do not echolocate, there is no potential for noise or other project effects to affect echolocation. The area around operating WTGs where operational noise may be above ambient noise is expected to be very small (50-100 m or less) and any effects to sei whales from avoiding that very small area would be insignificant. For HRG surveys, the best available data (Crocker and Fratantonio 2016) indicates that the area with noise above the level that would be disturbing to sei whales is very small (no more than 200 m from the sound source). Given the small area, the shutdown and clearance requirements, and that we only expect a whale exposed to that noise to swim just far enough away to avoid it (less than 200 m), effects are insignificant.

Up to 63 sei whales are expected to be exposed to pile driving or UXO detonation noise that will be loud enough to result in TTS or behavioral disturbance, inclusive of masking and stress, that would meet the NMFS interim definition of ESA harassment but not harm. A number of measures that are part of the proposed action, including a seasonal restriction on pile driving, requirements to use noise attenuation devices, minimum visibility requirements, and clearance and shutdown measures during pile driving monitored by PSOs on multiple platforms, reduce the potential for exposure of sei whales to pile driving noise. Similarly, measures that will be in place for any UXO detonations, including requirements to use noise attenuation devices, minimum visibility requirements, and clearance measures that include aerial surveys of the clearance zone, reduce the potential for exposure of sei whales to UXO detonations. However, even with these minimization measures in place, we expect 47 sei whales to experience TTS, temporary behavioral disturbance, and associated temporary physiological stress during the construction period due to exposure to pile driving noise. We also expect no more than 16 sei whales to experience TTS as a result of exposure to noise from UXO detonation. As explained in the *Effects of the Action* section, all of these impacts, including TTS, are expected to be temporary with normal behaviors resuming quickly after the noise ends (see Goldbogen et al. 2013a; Melcon et al. 2012). Any TTS will resolve within a week of exposure (that is, hearing sensitivity will return to normal within one week of exposure) and is not expected to affect the long-term health of any whale or its ability to migrate, forage, breed, or calve (Southall et al. 2008).

As explained in Section 7.1, as part of our consideration of the effects of noise exposure, we have also considered whether TTS, masking, or avoidance behaviors experienced by the sei whales exposed to noise above the behavioral disturbance threshold would be likely to result in vessel strike or entanglement in fishing gear. We would not expect the TTS to span the entire communication or hearing range of sei whales given the frequencies produced by pile driving do not span entire hearing ranges for sei whales. Additionally, though the frequency range of TTS that sei whales might sustain would overlap with some of the frequency ranges of their vocalization types, the frequency range of TTS from the proposed foundation installation activities would not span the entire frequency range of one vocalization type, much less span all types of vocalizations or other critical auditory cues for any given species. As such, we do not expect TTS to affect the ability of a blue whale to communicate with other blue whales or to detect audio cues to such an extent that it would prevent an animal from avoiding a vessel or other threat (considering whatever capacity audio cues are relevant to that avoidance behavior). Also, as explained in Section 7.1, we do not expect that avoidance of project noise would result in sei whales moving to areas with higher risk of vessel strike or entanglement in fishing gear; vessel strike or entanglement in fishing gear as a result of exposure to foundation installation noise is extremely unlikely to occur. This determination was made in consideration of the distance a whale is expected to travel to avoid disturbing levels of noise and the distribution of vessel traffic and fishing activity in the WDA and surrounding waters.

We have considered if pile driving noise may mask sei whale calls and could have effects on mother-calf communication and behavior. If a mother-calf pair was exposed to pile driving noise, we do not anticipate that masking would result in fitness consequences given their short-term nature. Any masking of communications or any delays in nursing due to swimming away from the pile driving noise would only last for the duration of the exposure to pile driving noise, up to 12 non-consecutive hours for a single day's pile driving. This temporary disruption is not expected to have any health consequences to the calf or mother due to its short-term duration and the ability to resume normal behaviors as soon as they are out of range of the disturbance.

Sei whales in the WDA are migrating and may forage in the WDA. Based on the best available information that indicates whales resume normal behavior quickly after the cessation of sound exposure (e.g., Goldbogen et al. 2013a; Melcon et al. 2012), we anticipate that the up to 63 sei whales exposed to harassing levels of noise will return to normal behavioral patterns after the exposure ends. As such, even if a sei whale exposed to pile driving noise was foraging, this disruption would be short term and impact foraging on more than a portion of one day.

As explained in Section 7.1, the duration of exposure to UXO detonations will be one second; for pile driving it could be up to 12 hours per day, with duration dependent on where the animal is when pile driving begins and how quickly it moves away from sound source. While exposure is not expected to exceed the period of active pile driving in a day (four to 12 hours), it is far more likely that any exposure and associated aversion/avoidance behavior would be for a significantly shorter period of time as a sei whale would be outside the clearance zone when pile driving started and is expected to swim away from the disturbing noise. Given the extremely short duration of UXO detonation (one second), we do not expect exposure to result in avoidance or displacement.

There would likely be an energetic cost associated with any temporary displacement or change in migratory route, but unless disruptions occur over long durations or over subsequent days, which we do not expect, we do not anticipate this movement to be consequential to the animal over the long term (see Southall et al. 2008). The energetic consequences of the evasive behavior and delay in resting are not expected to affect any individual's ability to successfully obtain enough food to maintain their health, or impact the ability of any individual to make seasonal migrations or participate in future breeding or calving. Stress responses are also anticipated with each of these instances of disruption. However, the available literature suggests these acoustically induced stress responses will be of short duration (similar to the duration of exposure), and not result in a chronic increase in stress that could result in physiological consequences to the animal (Southall et al. 2008). Given the short period of time during which individuals will be exposed to elevated noise, we do not anticipate long duration exposures to occur, and we do not anticipate the associated stress of exposure to result in significant costs to affected individuals**.**

After independent review and analysis applying the NMFS ESA interim definition of harassment, we determined that exposure of sei whales to levels of noise from pile driving and UXO above the behavioral disturbance threshold but below the auditory injury (PTS) threshold will result in 63 instances of ESA take by harassment. As described in greater detail in Section 7.1, we do not anticipate these instances of TTS and/or behavioral disturbance that meet the ESA definition of harassment but not harm to result in fitness consequences to the up to 63 individual sei whales to which this will occur. Our analysis considered the overall number of exposures to acoustic stressors that are expected to result in harassment, inclusive of behavioral responses, TTS, and stress, the duration and scope of the proposed activities expected to result in such impacts, the expected behavioral state of the animals at the time of exposure, and the expected condition of those animals. Instances of sei whale exposure to acoustic stressors are expected to be short-term, with the animal returning to its previous behavioral state shortly thereafter. As described previously, information is not available to conduct a quantitative analysis to determine the likely fitness consequences of these exposures and associated responses because we do not have information from wild cetaceans that links short-term behavioral responses to vital rates and animal health. Harris et al. (2017a) summarized the research efforts conducted to date that have attempted to understand the ways in which behavioral responses may result in long-term consequences to individuals and populations. Efforts have been made to try to quantify the potential consequences of such responses, and frameworks have been developed for this assessment (e.g., Population Consequences of Disturbance). However, models that have been developed to date to address this question require many input parameters and, for most species, there are insufficient data for parameterization (Harris et al. 2017a). Nearly all studies and experts agree that infrequent exposures of a single day or less are unlikely to impact an individual's overall energy budget (Farmer et al. 2018; Harris et al. 2017b; King et al. 2015b; NAS 2017; New et al. 2014; Southall et al. 2008; Villegas-Amtmann et al. 2015). Based on best available information, we expect this to be the case for sei whales exposed to acoustic stressors associated with this project even for animals that may already be in a stressed or compromised state due to factors unrelated to the SouthCoast project. Because we do not anticipate fitness consequences to individual sei whales to result from the ESA harassment resulting from TTS, behavioral disturbance, and associated stress, due to exposure to acoustic stressors, we do not expect any reductions in overall reproduction, abundance, or distribution of the sei whale population in the North Atlantic or rangewide. Based on the information provided here, the proposed action will not appreciably reduce the likelihood of survival of the sei whale (*i.e.*, it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment).

The proposed action will not result in any reduction in the abundance or reproduction of sei whales. Any effects to distribution will be limited to short-term alterations to normal movements by individuals to avoid disturbing levels of noise. There will be no change to the overall distribution of sei whales in the action area or throughout their range.

The proposed action is also not expected to affect recovery potential of the species. In the 2021 5-Year Review for sei whales, NMFS concluded that the recovery criteria outlined in the sei whale recovery plan (NMFS 2011) do not reflect the best available and most up-to-date information on the biology of the species. Therefore, we have not relied on the reclassification criteria specifically when considering the effects of the SouthCoast action on the recovery of the species. We know that in general, to recover, a listed species must have a sustained positive trend of increasing population over time. In general, mortality rates must be low enough to allow for recruitment to all age classes so that successful calving can continue over time and over generations. The SouthCoast project will not affect the status or trend of sei whales; this is because it will not result in the injury or mortality of any individuals or affect the ability of any individual to successfully reproduce or the ability of calves to grow to maturity. As such, the proposed action is not likely to affect the recovery potential of sei whales and is not likely to appreciably reduce the likelihood of recovery of North Atlantic right whales.

The proposed action will not affect the abundance of sei whales; this is, because no serious injury or mortality is anticipated, the project will not cause there to be fewer sei whales. The only effects to distribution of sei whales will be minor changes in the movements of the individuals exposed to pile driving noise or exposed to UXO detonation; there will be no changes in the distribution of the species in the action area or throughout its range. The proposed action will have no effect on reproduction because it will not affect the health of any potential mothers or the potential for successful breeding or calving; the project will not cause any reduction in reproduction. As explained above, the proposed action will not affect the recovery potential of the species. Based on this analysis, the proposed action is not likely to appreciably reduce the likelihood of both the survival and recovery of sei whales in the wild by reducing the reproduction, numbers, or distribution of that species. These conclusions were made in consideration of the endangered status of sei whales, other stressors that individuals are exposed to within the action area as described in the *Environmental Baseline* and *Cumulative Effects*, and any anticipated effects of climate change on the abundance, reproduction, and distribution of sei whales in the action area.

9.2.4 Sperm Whales

As described in further detail in the Status of the Species, the most recent estimate indicated a global population of between 300,000 and 450,000 individuals (Whitehead 2009). The higher estimates may be approaching population sizes prior to commercial whaling, the reason for ESA listing. No other more recent rangewide abundance estimates are available for this species (Waring et al. 2015). Hayes et al. (2020) reports that several estimates from selected regions of sperm whale habitat exist for select time periods, however, at present there is no reliable estimate of total sperm whale abundance for the entire North Atlantic. Sightings have been almost exclusively in the continental shelf edge and continental slope areas; however, there has been little or no survey effort beyond the slope. The best recent abundance estimate for sperm whales in the North Atlantic is the sum of the 2016 surveys— 4,349 (CV=0.28) (Hayes et al. 2020).

Entanglement in fishing gear and vessel strikes as described in the *Environmental Baseline*, may occur in the action area over the life of the proposed action. As noted in the *Cumulative Effects* section of this Opinion, we have not identified any cumulative effects different from those considered in the *Status of the Species* and *Environmental Baseline* sections of this Opinion, inclusive of how those activities may contribute to climate change. As described in Section 7.10, climate change may result in changes in the distribution or abundance of sperm whales in the overall action area over the life of this project, but given the shallow depths of the lease area, any change in distribution of sperm whales over time is not expected to result in any change in use of the lease area. We have not identified any different or exacerbated effects of the action in the context of anticipated climate change.

As explained in the Section 7.0 *Effects of the Action* of this Opinion, the only adverse effects to sperm whales expected to result from the SouthCoast project are temporary behavioral disturbance and/or temporary threshold shift (minor and temporary hearing impairment) resulting from acoustic exposure to pile driving or UXO detonations; these adverse effects meet NMFS interim ESA definition of harassment. These adverse effects will be experienced by up to 139 individual sperm whales as a result of exposure to noise from pile driving (135) and UXO detonation (4). No injury (auditory or other), serious injury or mortality is expected due to exposure to any aspect of the proposed action during the construction, operations, or decommissioning phases of the project.

The distribution of sperm whales overlaps with some parts of the vessel transit routes that will be used through the 43 to 47-year life of the project. A number of measures designed to reduce the risk of vessel strike, including deploying lookouts and traveling at reduced speeds in areas where sperm whales are most likely to occur, are part of the proposed action. As explained in Section 7.2, we have determined that strike of a sperm whale by a project vessel is extremely unlikely to occur. As such, vessel strike of a sperm whale and any associated injury or mortality is not an expected outcome of the SouthCoast project.

Based on the type of survey gear that will be deployed, any effects to sperm whales from the surveys of fishery resources planned by SouthCoast and considered as part of the proposed action are extremely unlikely to occur. As such, capture or entanglement of a sperm whale and any associated injury or mortality is not an expected outcome of the SouthCoast project.

As explained in Section 7.1, the effects of exposure to WTG operational noise and noise associated with other project activities (e.g., HRG surveys, vessels) are expected to be insignificant. We also determined that effects of construction, operation, and decommissioning, inclusive of project noise, would have insignificant effects on sperm whale prey. Potential effects to echolocation are also insignificant. The area around operating WTGs where operational noise may be above ambient noise is expected to be very small and any effects to sperm whales from avoiding that very small area would be insignificant. For HRG surveys, the best available data (Crocker and Fratantonio 2016) indicates that the area with noise above the level that would be disturbing to sperm whales is very small (no more than 100 m from the sound source). Given the small area, the shutdown and clearance requirements, and that we only expect a whale exposed to that noise to swim just far enough away to avoid it (less than 100 m), effects are insignificant.

No sperm whales are expected to be exposed to noise from pile driving or UXO detonation that could result in PTS or any other injury. Measures that will be in place for any UXO detonations and pile driving, including requirements to use noise attenuation devices, minimum visibility requirements, and clearance measures, are expected to eliminate the potential for exposure of sperm whales to noise above the auditory injury (PTS) threshold during UXO detonations and pile driving. With these measures in place, we do not anticipate the exposure of any sperm whales to noise that could result in PTS, other injury, or mortality. However, even with these minimization measures in place, we expect up to 135 sperm whales will experience TTS, temporary behavioral disturbance, and associated temporary physiological stress during the construction period due to exposure to pile driving noise that would meet the NMFS interim definition of ESA harassment. We also expect no more than 4 sperm whale to experience TTS as a result of exposure to noise from UXO detonation. We have determined that the effects experienced by these 139 sperm whales meet the ESA definition of harassment, but not harm. As explained in the *Effects of the Action* section, all of these impacts, including TTS, are expected to be temporary with normal behaviors resuming quickly after the noise ends (see Goldbogen et al. 2013a; Melcon et al. 2012). Any TTS will resolve within a week of exposure (that is, hearing sensitivity will return to normal within one week of exposure) and is not expected to affect the health of any whale or its ability to migrate, forage, breed, or calve (Southall et al. 2008).

As explained in Section 7.1, as part of our consideration of the effects of noise exposure, we have also considered whether TTS, masking, or avoidance behaviors experienced by the sperm whales exposed to noise above the behavioral disturbance threshold would be likely to result in vessel strike or entanglement in fishing gear. We would not expect the TTS to span the entire communication or hearing range of sperm whales given the frequencies produced by pile driving do not span entire hearing ranges for sperm whales. Additionally, though the frequency range of TTS that sperm whales might sustain would overlap with some of the frequency ranges of their vocalization types, the frequency range of TTS from the proposed foundation installation activities would not span the entire frequency range of one vocalization type, much less span all types of vocalizations or other critical auditory cues for any given species. As such, we do not expect TTS to affect the ability of a sperm whale to communicate with other sperm whales or to detect audio cues to such an extent that it would prevent an animal from avoiding a vessel or other threat (considering whatever capacity audio cues are relevant to that avoidance behavior). Also, as explained in Section 7.1, we do not expect that avoidance of project noise would result in sperm whales moving to areas with higher risk of vessel strike or entanglement in fishing gear; vessel strike or entanglement in fishing gear as a result of exposure to foundation installation noise is extremely unlikely to occur. This determination was made in consideration of the distance a whale is expected to travel to avoid disturbing levels of noise and the distribution of vessel traffic and fishing activity in the WDA and surrounding waters.

We have considered if pile driving noise may mask sperm whale calls and could have effects on mother-calf communication and behavior. As noted in Section 7.1, presence of mother-calf pairs is unlikely in the WDA. However, even if a mother-calf pair was exposed to pile driving noise, we do not anticipate that masking would result in fitness consequences given their short-term nature. Any masking of communications or any delays in nursing due to swimming away from the pile driving noise would only last for the duration of the exposure to pile driving noise, which in all cases would be no more than approximately 12 hours in a single day. This temporary disruption is not expected to have any health consequences to the calf or mother due to its short-term duration and the ability to resume normal behaviors as soon as they are out of range of the disturbance.

We expect that sperm whales in the WDA are migrating. Foraging is expected to be rare due to the nearshore location and shallow depths. Based on the best available information that indicates whales resume normal behavior quickly after the cessation of sound exposure (e.g., Goldbogen et al. 2013a; Melcon et al. 2012), we anticipate that the sperm whales exposed to pile driving or UXO detonations will return to normal behavioral patterns after the exposure ends. As such, even if foraging was disrupted, this disruption would be short term and impact foraging on no more than a portion of a single day.

As explained in Section 7.1, the duration of exposure to UXO detonations will be one second; for pile driving it could be up to 12 hours per day, with duration dependent on where the animal is when pile driving begins and how quickly it moves away from sound source. While exposure is not expected to exceed the period of active pile driving in a day (four to 12 hours), it is far more likely that any exposure and associated aversion/avoidance behavior would be for a significantly shorter period of time as a sperm whale would be outside the clearance zone when pile driving started and is expected to swim away from the disturbing noise. Given the extremely short duration of UXO detonation (one second), we do not expect exposure to result in avoidance or displacement.

There would likely be an energetic cost associated with any temporary displacement or change in migratory route, but unless disruptions occur over long durations or over subsequent days, which we do not expect, we do not anticipate this movement to be consequential to the animal over the long term (see Southall et al. 2008). The energetic consequences of the evasive behavior and delay in resting are not expected to affect any individual's ability to successfully obtain enough food to maintain their health, or impact the ability of any individual to make seasonal migrations or participate in future breeding or calving. Stress responses are also anticipated with each of these instances of disruption. However, the available literature suggests these acoustically induced stress responses will be of short duration (similar to the duration of exposure), and not result in a chronic increase in stress that could result in physiological consequences to the animal (Southall et al. 2008). Given the short period of time during which elevated noise will be experienced, we do not anticipate long duration exposures to occur, and we do not anticipate the associated stress of exposure to result in significant costs to affected individuals**.**

After independent review and analysis applying the NMFS ESA interim definition of harassment we have determined that exposure to pile driving and UXO noise above behavioral disturbance but below injury (PTS) thresholds will result in 139 instances of ESA take by harassment. As described in greater detail in Section 7.1, we do not anticipate these instances of TTS and behavioral disturbance that we have determined meet the ESA definition of harassment, but not harm, to result in fitness consequences to the up to 139 sperm whales to which this will occur. Our analysis considered the overall number of exposures to acoustic stressors that are expected to result in harassment, inclusive of behavioral responses, TTS, and stress, the duration and scope of the proposed activities expected to result in such impacts, the expected behavioral state of the animals at the time of exposure, and the expected condition of those animals. Instances of sperm whale exposure to acoustic stressors are expected to be short-term, with the animal returning to its previous behavioral state shortly thereafter. As described previously, information is not available to conduct a quantitative analysis to determine the likely fitness consequences of these exposures and associated responses because we do not have information from wild cetaceans that links short-term behavioral responses to vital rates and animal health. Harris et al. (2017a) summarized the research efforts conducted to date that have attempted to understand the ways in which behavioral responses may result in long-term consequences to individuals and populations. Efforts have been made to try to quantify the potential consequences of such responses, and frameworks have been developed for this assessment (e.g., Population Consequences of Disturbance). However, models that have been developed to date to address this question require many input parameters and, for most species, there are insufficient data for parameterization (Harris et al. 2017a). Nearly all studies and experts agree that infrequent exposures of a single day or less are unlikely to impact an individual's overall energy budget (Farmer et al. 2018; Harris et al. 2017b; King et al. 2015b; NAS 2017; New et al. 2014; Southall et al. 2008; Villegas-Amtmann et al. 2015). Based on best available information, we expect this to be the case for sperm whales exposed to acoustic stressors associated with this project even for animals that may already be in a stressed or compromised state due to factors unrelated to the SouthCoast project.

We do not expect any injury, serious injury, or mortality of any sperm whale to result from the proposed action. We do not expect the action to affect the health of any sperm whale. We also do not anticipate fitness consequences to any individual sperm whales; that is, we do not expect any effects on any individual's ability to reproduce or generate viable offspring. Because we do not anticipate any reduction in fitness, we do not anticipate any future effects on reproductive success. Any effects to distribution will be limited to short-term alterations to normal movements by individuals to avoid disturbing levels of noise. Based on the information provided here, the proposed action will not appreciably reduce the likelihood of survival of the sperm whale (*i.e.*, it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment).

The proposed action is not likely to affect the recovery potential of sperm whales. In making this determination we have considered generalized needs for species recovery and the goals and criteria identified in the 2010 Recovery Plan for sperm whales. We know that in general, to recover, a listed species must have a sustained positive trend of increasing population over time. In general, mortality rates must be low enough to allow for recruitment to all age classes so that successful calving can continue over time and over generations. The 2010 Recovery Plan contains downlisting and delisting criteria. As sperm whales are listed as endangered, we have considered whether the proposed action is likely to affect the likelihood that these criteria will be met or the time it takes to meet these criteria. The Plan states that sperm whales may be considered for reclassifying to threatened when all of the following have been met:

1. Given current and projected threats and environmental conditions, the sperm whale population in each ocean basin in which it occurs (Atlantic Ocean/Mediterranean Sea, Pacific Ocean, and Indian Ocean) satisfies the risk analysis standard for threatened status (has no more than a 1% chance of extinction in 100 years) and the global population has at least 1,500 mature, reproductive individuals (consisting of at least 250 mature females and at least 250 mature males in each ocean basin). Mature is defined as the number of individuals known, estimated, or inferred to be capable of reproduction. Any factors or circumstances that are thought to substantially contribute to a real risk of extinction that cannot be incorporated into a Population Viability Analysis will be carefully considered before downlisting takes place; and,

2. None of the known threats to sperm whales is known to limit the continued growth of populations. Specifically, the factors in 4(a)(l) of the ESA are being or have been addressed: A) the present or threatened destruction, modification or curtailment of a species' habitat or range; B) overutilization for commercial, recreational or educational purposes; C) disease or predation; D) the inadequacy of existing regulatory mechanisms; and E) other natural or manmade factors.

The proposed action will not result in any condition that impacts the time it will take to reach these goals or the likelihood that these goals will be met. This is because the proposed action will not affect the trend of the species or prevent or delay it from achieving an increasing population or otherwise affect its growth rate and will not affect the chance of extinction. That is, the proposed action will not appreciably reduce the likelihood of recovery of sperm whales.

The proposed action will not affect the abundance of sperm whales; this is, because no serious injury or mortality is anticipated, the project will not cause there to be fewer sperm whales. The only effects to distribution of sperm whales will be minor changes in the movements of up to 135 individuals exposed to pile driving noise and 4o individuals exposed to UXO detonations; there will be changes in the distribution of the species throughout the action area or throughout its range. The proposed action will have no effect on reproduction because it will not affect the health of any potential mothers or the potential for successful breeding or calving; the project will not cause any reduction in reproduction. As explained above, the proposed action will not affect the recovery potential of the species. For these reasons, the effects of the proposed action are not likely to appreciably reduce the likelihood of both the survival and recovery of sperm whales in the wild by reducing the reproduction, numbers, or distribution of that species. These conclusions were made in consideration of the endangered status of sperm whales, other stressors that individuals are exposed to within the action area as described in the *Environmental Baseline* and *Cumulative Effects*, and any anticipated effects of climate change on the abundance, reproduction, and distribution of sperm whales in the action area.

9.2.5 Blue Whales

As described in further detail in the Status of the Species, the most recent estimate indicated a global population of between 5,000 – 12,000 individuals globally (IWC 2007). Potential threats to blue whales identified in the 2020 Recovery Plan include ship strikes, entanglement in fishing gear and marine debris, anthropogenic noise, and loss of prey base due to climate and ecosystem change (NMFS 2020). There are no recent confirmed records of anthropogenic mortality or serious injury to blue whales in the U.S. Atlantic EEZ or in Atlantic Canadian waters (Henry et al. 2020). The total level of human caused mortality and serious injury is unknown, but it is believed to be insignificant and approaching a zero mortality and serious injury rate (Hayes et al. 2020). Because populations appear to be increasing in size, the species appears to be somewhat resilient to current threats; however, the species has not recovered to pre-exploitation levels.

As noted in the *Cumulative Effects* section of this Opinion, we have not identified any cumulative effects different from those considered in the *Status of the Species* and *Environmental Baseline* sections of this Opinion, inclusive of how those activities may contribute to climate change. As described in Section 7.10, climate change may result in changes in the distribution or abundance of blue whales in the overall action area over the life of this project, but given the shallow depths of the lease area, any change in distribution of blue whales over time is not expected to result in any change in use of the lease area. We have not identified any different or exacerbated effects of the action in the context of anticipated climate change.

As explained in the Section 7.0 *Effects of the Action* of this Opinion, the only adverse effects to blue whales expected to result from the SouthCoast project are temporary behavioral disturbance and/or temporary threshold shift (minor and temporary hearing impairment); these adverse effects meet NMFS interim ESA definition of harassment. These adverse effects will be experienced by up to 4 individual blue whales as a result of exposure to noise from pile driving (2) and UXO detonation (2). No injury (auditory or other) or mortality is expected due to exposure to any aspect of the proposed action during the construction, operations, or decommissioning phases of the project.

The distribution of blue whales overlaps with some parts of the vessel transit routes that will be used through the 43 to 47-year life of the project. A number of measures designed to reduce the risk of vessel strike, including deploying lookouts and traveling at reduced speeds in areas where blue whales are most likely to occur, are part of the proposed action. As explained in Section 7.2, we have determined that strike of a blue whale by a project vessel is extremely unlikely to occur. As such, vessel strike of a blue whale and any associated injury or mortality is not an expected outcome of the SouthCoast project.

Based on the type of survey gear that will be deployed, effects to blue whales from the surveys of fishery resources planned by SouthCoast and considered as part of the proposed action are extremely unlikely to occur. As such, capture or entanglement of a blue whale and any associated injury or mortality is not an expected outcome of the SouthCoast project.

As explained in Section 7.1, the effects of exposure to WTG operational noise and noise associated with other project activities (e.g., HRG surveys, vessels) are expected to be insignificant. We also determined that effects of construction, operation, and decommissioning, inclusive of project noise, will have insignificant effects on blue whale prey. The area around operating WTGs where operational noise may be above ambient noise is expected to be very small (50 -100 m or less) and any effects to blue whales from avoiding that very small area would be insignificant. For HRG surveys, the best available data (Crocker and Fratantonio 2016) indicates that the area with noise above the level that would be disturbing to blue whales is very small (no more than 200 m from the sound source). Given the small area, the shutdown and clearance requirements, and that we only expect a whale exposed to that noise to swim just far enough away to avoid it (less than 200 m), effects are insignificant.

Up to 4 blue whales are expected to be exposed to noise from foundation installation or UXO detonation that will be loud enough to result in TTS or behavioral disturbance, inclusive of masking and stress, which together would result in significant disruption of behavioral patterns that would meet the NMFS interim definition of ESA harassment but not harm. A number of measures that are part of the proposed action, including a seasonal restriction on pile driving, requirements to use noise attenuation devices, minimum visibility requirements, and clearance and shutdown measures during pile driving and UXO detonations monitored by PSOs on multiple platforms, reduce the potential for exposure of blue whales to foundation installation noise or UXO detonations. However, even with these minimization measures in place, we expect 4 blue whales to experience TTS, temporary behavioral disturbance, and associated temporary physiological stress during the construction period due to exposure to pile driving or UXO detonations. As explained in the *Effects of the Action* section, behaviors that are disrupted as a result of avoidance/aversion from the noise source would resume quickly after the noise ends (see Goldbogen et al. 2013a; Melcon et al. 2012). Any TTS will resolve within a week of exposure (that is, hearing sensitivity will return to normal within one week of exposure) and is not expected to affect the long-term health of any whale or its ability to migrate, forage, breed, or calve (Southall et al. 2008).

As explained in Section 7.1, as part of our consideration of the effects of noise exposure, we have also considered whether TTS, masking, or avoidance behaviors experienced by the 4 blue whales exposed to noise above the behavioral disturbance threshold would be likely to result in vessel strike or entanglement in fishing gear. We would not expect the TTS to span the entire communication or hearing range of blue whales given the frequencies produced by pile driving do not span entire hearing ranges for blue whales. Additionally, though the frequency range of TTS that blue whales might sustain would overlap with some of the frequency ranges of their vocalization types, the frequency range of TTS from the proposed foundation installation activities would not span the entire frequency range of one vocalization type, much less span all types of vocalizations or other critical auditory cues for any given species. As such, we do not expect TTS to affect the ability of a blue whale to communicate with other blue whales or to detect audio cues to such an extent that it would prevent an animal from avoiding a vessel or other threat (considering whatever capacity audio cues are relevant to that avoidance behavior). Also, as explained in Section 7.1, we do not expect that avoidance of project noise would result in blue whales moving to areas with higher risk of vessel strike or entanglement in fishing gear; vessel strike or entanglement in fishing gear as a result of exposure to foundation installation noise is extremely unlikely to occur. This determination was made in consideration of the distance a whale is expected to travel to avoid disturbing levels of noise and the distribution of vessel traffic and fishing activity in the WDA and surrounding waters.

We have considered if pile driving noise may mask blue whale calls and could have effects on mother-calf communication and behavior. As noted in Section 7.1, presence of mother-calf pairs is unlikely in the WDA. However, even if a mother-calf pair was exposed to pile driving noise, we do not anticipate that masking would result in fitness consequences given their short-term nature. Any masking of communications or any delays in nursing due to swimming away from the pile driving noise would only last for the duration of the exposure to pile driving noise, which in all cases would be no more than approximately 12 non-consecutive hours in a single day. This temporary disruption is not expected to have any health consequences to the calf or mother due to its short-term duration and the ability to resume normal behaviors as soon as they are out of range of the disturbance.

We expect that blue whales in the WDA are migrating; opportunistic foraging may also occur. Based on the best available information that indicates whales resume normal behavior quickly after the cessation of sound exposure (e.g., Goldbogen et al. 2013a; Melcon et al. 2012), we anticipate that the up to 4 blue whales exposed to pile driving or UXO detonations will return to normal behavioral patterns after the exposure ends. As such, even if foraging was disrupted, this disruption would be short term and impact foraging on no more than a portion of a single day.

As explained in Section 7.1, the duration of exposure to UXO detonations will be one second; for pile driving it could be up to 12 hours per day, with duration dependent on where the animal is when pile driving begins and how quickly it moves away from sound source. While exposure is not expected to exceed the period of active pile driving in a day (four to 12 hours), it is far more likely that any exposure and associated aversion/avoidance behavior would be for a significantly shorter period of time as a blue whale would be outside the clearance zone when pile driving started and is expected to swim away from the disturbing noise. Given the extremely short duration of UXO detonation (one second), we do not expect exposure to result in avoidance or displacement.

There would likely be an energetic cost associated with any temporary displacement or change in migratory route, but unless disruptions occur over long durations or over subsequent days, which we do not expect, we do not anticipate this movement to be consequential to the animal over the long term (see Southall et al. 2008). The energetic consequences of the evasive behavior and delay in resting are not expected to affect any individual's ability to successfully obtain enough food to maintain their health, or impact the ability of any individual to make seasonal migrations or participate in future breeding or calving. Stress responses are also anticipated with each of these instances of disruption. However, the available literature suggests these acoustically induced stress responses will be of short duration (similar to the duration of exposure), and not result in a chronic increase in stress that could result in physiological consequences to the animal (Southall et al. 2008). Given the short period of time during which elevated noise will be experienced, we do not anticipate long duration exposures to occur, and we do not anticipate the associated stress of exposure to result in long-term costs to affected individuals**.**

After independent review and analysis applying the NMFS ESA interim guidance definition of harassment, we determined that exposure of sei whales to levels of noise from pile driving and UXO above the behavioral disturbance threshold but below the auditory injury (PTS) threshold will result in 4 instances of ESA take by harassment. As described in detail in Section 7.1, we do not anticipate these instances of TTS and behavioral disturbance that meet the ESA harassment but not harm, to result in fitness consequences to the up to 4 blue whales to which this will occur. Our analysis considered the overall number of exposures to acoustic stressors that are expected to result in harassment, inclusive of behavioral responses, TTS, and stress, the duration and scope of the proposed activities expected to result in such impacts, the expected behavioral state of the animals at the time of exposure, and the expected condition of those animals. Instances of blue whale exposure to acoustic stressors are expected to be short-term, with the animal returning to its previous behavioral state shortly thereafter. As described previously, information is not available to conduct a quantitative analysis to determine the likely fitness consequences of these exposures and associated responses because we do not have information from wild cetaceans that links short-term behavioral responses to vital rates and animal health. Harris et al. (2017a) summarized the research efforts conducted to date that have attempted to understand the ways in which behavioral responses may result in long-term consequences to individuals and populations. Efforts have been made to try to quantify the potential consequences of such responses, and frameworks have been developed for this assessment (e.g., Population Consequences of Disturbance). However, models that have been developed to date to address this question require many input parameters and, for most species, there are insufficient data for parameterization (Harris et al. 2017a). Nearly all studies and experts agree that infrequent exposures of a single day or less are unlikely to impact an individual's overall energy budget (Farmer et al. 2018; Harris et al. 2017b; King et al. 2015b; NAS 2017; New et al. 2014; Southall et al. 2008; Villegas-Amtmann et al. 2015). Based on best available information, we expect this to be the case for blue whales exposed to acoustic stressors associated with this project even for animals that may already be in a stressed or compromised state due to factors unrelated to the SouthCoast project. Because we do not anticipate fitness consequences to individual blue whales to result from the ESA harassment resulting from TTS, behavioral disturbance, and associated stress, due to exposure to acoustic stressors, we do not expect any reductions in overall reproduction, abundance, or distribution of the blue whale population in the North Atlantic or rangewide. Based on the information provided here, the proposed action will not appreciably reduce the likelihood of survival of the blue whale (*i.e.*, it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment).

The proposed action will not result in any reduction in the abundance or reproduction of blue whales. Any effects to distribution will be limited to short-term alterations to normal movements by individuals to avoid disturbing levels of noise. There will be no change to the overall distribution of blue whales in the action area or throughout their range.

The proposed action is not likely to affect the recovery potential of blue whales. In making this determination we have considered generalized needs for species recovery and the goals and criteria identified in the 2020 Recovery Plan for blue whales. We know that in general, to recover, a listed species must have a sustained positive trend of increasing population over time. In general, mortality rates must be low enough to allow for recruitment to all age classes so that successful calving can continue over time and over generations. The two main objectives for blue whales identified in the 2020 Recovery Plan are to:

> 1) increase blue whale resiliency and ensure geographic and ecological representation by achieving sufficient and viable populations in all ocean basins and in each recognized subspecies, and 2) increase blue whale resiliency by managing or eliminating significant anthropogenic threats. The Recovery Plan includes recovery criteria that address minimum abundance in each of the nine management units (abundance of 500 or 2,000

whales depending on the unit); stable or increasing trend in each of the nine management units; and criteria related to threat identification and minimization (NMFS 2020). The Recovery Plan also includes delisting criteria that address abundance, trends, and threat minimization/elimination (NMFS 2020).

The proposed action will not result in any condition that impacts the time it will take to reach these goals or the likelihood that these goals will be met. This is because the proposed action will not affect the trend of the species or prevent or delay it from achieving an increasing population or otherwise affect its growth rate and will not affect the chance of extinction. That is, the proposed action will not appreciably reduce the likelihood of recovery of blue whales.

The proposed action will not affect the abundance of blue whales; this is, because no mortality is anticipated, the project will not cause there to be fewer blue whales. The only effects to distribution of blue whales will be minor changes in the movements of up to 2 individual exposed to pile driving noise and 2 individual exposed to UXO detonation; there will be changes in the distribution of the species throughout the action area or throughout its range. The proposed action will have no effect on reproduction because it will not affect the health of any potential mothers or the potential for successful breeding or calving; the project will not cause any reduction in reproduction. As explained above, the proposed action will not affect the recovery potential of the species. For these reasons, the effects of the proposed action are not likely to appreciably reduce the likelihood of both the survival and recovery of blue whales in the wild by reducing the reproduction, numbers, or distribution of that species. These conclusions were made in consideration of the endangered status of blue whales, other stressors that individuals are exposed to within the action area as described in the *Environmental Baseline* and *Cumulative Effects*, and any anticipated effects of climate change on the abundance, reproduction, and distribution of blue whales in the action area.

9.3 Sea Turtles

Our effects analysis determined that pile driving and UXO detonation are likely to adversely affect a number of individual ESA-listed sea turtles in the action area. We quantify the number of leatherback and loggerhead sea turtles we expect to be harmed (auditory injury) and the number of leatherback, loggerhead, Kemp's ridley, and green sea turtles that we expect to be harassed. We determined that exposure to other project noise, including HRG surveys and operational noise will have effects that are insignificant or discountable. We expect that project vessels will strike and kill no more than 19 leatherback, 19 loggerhead, 2 green, and 2 Kemp's ridley sea turtle over the 43 to 47-year life of the project, inclusive of the construction, operation, and decommissioning period. We expect that a number of sea turtles will be captured in the trawl surveys and be released alive. We do not expect the entanglement or capture of any sea turtles in any other fisheries surveys. We also determined that effects to sea turtles from project impacts on habitat and prey are insignificant or discountable.

While this biological opinion relies on the best available scientific and commercial information, our analysis and conclusions include uncertainty about the basic hearing capabilities of sea turtles, such as how they use sound to perceive and respond to environmental cues, and how temporary changes to their acoustic soundscape could affect the normal physiology and behavioral ecology of these species. Vessel strikes are expected to result in more significant effects on individuals than other stressors considered in this Opinion because these strikes are expected to result in serious injury or mortality. Those that are killed and removed from the population would decrease reproductive rates, and those that sustain non-lethal injuries and permanent hearing impairment could have fitness consequences during the time it takes to fully recover, or have long lasting impacts if permanently harmed. Temporary hearing impairment and significant behavioral disruption from harassment could have similar effects, but given the duration of exposures, these impacts are expected to be temporary and a sea turtle's hearing is expected to return to normal shortly after the exposure ends (i.e., within a few days). Therefore, these temporary effects are expected to exert significantly less adverse effects on any individual than severe injuries and permanent non-lethal injuries.

In this section, we assess the likely consequences of these effects to the sea turtles that have been exposed to the identified activity/stressor, the populations those individuals represent, and the species those populations comprise. Section 5.2 described current sea turtle population statuses and the threats to their survival and recovery. Most sea turtle populations have undergone significant to severe reduction by human harvesting of both eggs and sea turtles, loss of beach nesting habitats, as well as severe bycatch pressure in worldwide fishing industries. The *Environmental Baseline* identified actions expected to generally continue for the foreseeable future for each of these species of sea turtle that may affect sea turtles in the action area. As described in Section 7.10, climate change may result in a northward distribution of sea turtles, which could result in a small change in the abundance, and seasonal distribution of sea turtles in the action area over the 43 to 47-year life of the SouthCoast project. However, as described there, given the cool winter water temperatures in the action area and considering the amount of warming that is anticipated, any shift in seasonal distribution is expected to be small (potential additional weeks per year, not months) and any increase in abundance in the action area is expected to be small. As noted in the *Cumulative Effects* section of this Opinion, we have not identified any cumulative effects different from those considered in the *Status of the Species* and *Environmental Baseline* sections of this Opinion, inclusive of how those activities may contribute to climate change.

9.3.1 Northwest Atlantic DPS of Loggerhead Sea Turtles

The Northwest Atlantic DPS of loggerhead sea turtles is listed as threatened. Based on nesting data and population abundance and trends at the time, NMFS and USFWS determined in 2011 that the Northwest Atlantic DPS should be listed as threatened and not endangered based on: (1) the large size of the nesting population, (2) the overall nesting population remains widespread, (3) the trend for the nesting population appears to be stabilizing, and (4) substantial conservation efforts are underway to address threats (76 FR 58868, September 22, 2011).

It takes decades for loggerhead sea turtles to reach maturity. Once they have reached maturity, females typically lay multiple clutches of eggs within a season, but do not typically lay eggs every season (NMFS and USFWS 2008). There are many natural and anthropogenic factors affecting the survival of loggerheads prior to their reaching maturity as well as for those adults who have reached maturity. As described in the *Status of the Species*, *Environmental Baseline*, and *Cumulative Effects* sections above, loggerhead sea turtles in the action area continue to be affected by multiple anthropogenic impacts including bycatch in commercial and recreational fisheries, habitat alteration, vessel interactions, and other factors that result in mortality of individuals at all life stages. Negative impacts causing death of various age classes occur both on land and in the water. Many actions have been taken to address known negative impacts to loggerhead sea turtles. However, others remain unaddressed, have not been sufficiently addressed, or have been addressed in some manner but whose success cannot be quantified.

There are five subpopulations of loggerhead sea turtles in the western North Atlantic (recognized as recovery units in the 2008 recovery plan for the species). These subpopulations show limited evidence of interbreeding. As described in the *Status of the Species*, recent assessments have evaluated the nesting trends for each recovery unit. Nesting trends are based on nest counts or nesting females; they do not include non-nesting adult females, adult males, or juvenile males or females in the population. Nesting trends for each of the loggerhead sea turtle recovery units in the Northwest Atlantic Ocean DPS are variable. Overall, short-term trends have shown increases, however, over the long-term the DPS is considered stable.

Estimates of the total loggerhead population in the Atlantic are not currently available. However, there is some information available for portions of the population. From 2004-2008, the loggerhead adult female population for the Northwest Atlantic ranged from 20,000 to 40,000 or more individuals (median 30,050), with a large range of uncertainty in total population size (SEFSC 2009). The estimate of Northwest Atlantic adult loggerhead females was considered conservative for several reasons. The number of nests used for the Northwest Atlantic was based primarily on U.S. nesting beaches. Thus, the results are a slight underestimate of total nests because of the inability to collect complete nest counts for many non-U.S. nesting beaches within the DPS. In estimating the current population size for adult nesting female loggerhead sea turtles, the report simplified the number of assumptions and reduced uncertainty by using the minimum total annual nest count (i.e., 48,252 nests) over the five years. This was a particularly conservative assumption considering how the number of nests and nesting females can vary widely from year to year (e.g., the 2008 nest count was 69,668 nests, which would have increased the adult female estimate proportionately to between 30,000 and 60,000). In addition, minimal assumptions were made about the distribution of remigration intervals and nests per female parameters, which are fairly robust and well known. A loggerhead population estimate using data from 2001-2010 estimated the loggerhead adult female population in the Northwest Atlantic at 38,334 individuals (SD =2,287) (Richards et al. 2011). These population studies are consistent with the definition of the Northwest Atlantic DPS.

The AMAPPS surveys and sea turtle telemetry studies conducted along the U.S. Atlantic coast in the summer of 2010 provided preliminary regional abundance estimate of about 588,000 loggerheads along the U.S. Atlantic coast, with an inter-quartile range of 382,000-817,000 (NMFS 2011c). The estimate increases to approximately 801,000 (inter-quartile range of 521,000-1,111,000) when based on known loggerheads and a portion of unidentified sea turtle sightings (NMFS 2011c). Although there is much uncertainty in these population estimates, they provide some context for evaluating the size of the likely population of loggerheads in the Northwest Atlantic, which is an indication of the size of the Northwest Atlantic DPS.

The impacts to loggerhead sea turtles from the proposed action are expected to result in: the mortality of 19 individuals due to vessel strike over the 43-47-year construction, operations and decommissioning period; the capture of up to 1 loggerhead during the trawl surveys, we expect these individuals will be released alive with only minor, recoverable injuries (minor scrapes and abrasions); the harm of 2 loggerhead as a result of experiencing PTS due to exposure to pile driving noise; and, the exposure of up to 9 loggerhead sea turtles from the DPS to pile driving noise that will result in TTS and/or behavioral disturbance that meets the ESA definition of harassment. We determined that all other effects of the action would be insignificant or extremely unlikely to occur. In total, we expect the proposed action to result in the mortality of up to 19 loggerheads over the 43 to 47-year life of the project.

The 9 loggerhead sea turtles that experience harassment would experience behavioral disturbance and could suffer temporary hearing impairment (TTS); we also expect these turtles would experience physiological stress during the period that their normal behavioral patterns are disrupted (i.e., a period of several days). Aversion/avoidance behavior would be limited to the short period of time the animal is exposed to pile driving noise; TTS and associated disruptions to normal behavioral patterns (migrating, resting, feeding) will persist for a few days but are not expected to be experienced for more than a week. Any sea turtles affected by TTS would experience a temporary, recoverable, hearing loss manifested as a threshold shift around the frequency of the pile driving detonation noise (as relevant for the exposure). Sea turtles are not known to depend heavily on acoustic cues for vital biological functions (Nelms et al. 2016; Popper et al. 2014), and instead, may rely primarily on senses other than hearing for interacting with their environment, such as vision and magnetic orientation (Avens and Lohmann 2003; Putman et al. 2015). Because sea turtles do not vocalize or use noise to communicate, any TTS would not impact communications. However, to the extent that sea turtles do rely on acoustic cues from their environment, we expect that this temporary hearing impairment would affect frequencies utilized by sea turtles for acoustic cues such as the sound of waves, coastline noise, or the presence of a vessel or predator (Narazaki et al. 2013). If such cues increase survivorship (e.g., aid in avoiding predators, navigation), temporary loss of hearing sensitivity may have effects on the ability of a sea turtle to avoid threats which could decrease its ability to avoid those threats; this would be a significant disruption of behavioral patterns that creates the likelihood of injury. TTS of sea turtles is expected to only last for several days following the initial exposure (Moein et al. 1994). Given this short period of time, and that sea turtles are not known to rely heavily on acoustic cues, while TTS may impact the ability of affected individuals to avoid threats during the few days that TTS is experienced, we do not anticipate single TTSs would have any long-term impacts on the health or reproductive capacity or success of individual sea turtles.

The energetic consequences of avoidance/aversion behavior and any associated delay in resting or foraging will be disruptive for the period of time that the individual is exposed to the noise source. Similar effects are likely to be experienced in the period before the animal recovers from TSS. However, the limited duration means that these consequences are not expected to affect any individual's ability to successfully obtain enough food to maintain their health, or impact the ability of any individual to make seasonal migrations or participate in breeding or nesting. As a result of the energetic costs, evasive behaviors, and temporary impact on the ability to detect environmental cues which could affect the ability to avoid threats, TTS and behavioral disruption will create or increase the risk of injury for the affected sea turtles compared to those that are not exposed to these noise sources. However, as established herein, the temporary and limited nature of these effects means that it is unlikely that the behavioral disruption and temporary loss of hearing sensitivity would affect an individual sea turtle's fitness (i.e., survival or reproduction). As explained in Section 7.2 of this Opinion, we determined that effects to these 9 loggerhead sea turtles meet NMFS interim definition of harassment but not the definition of harm.

We expect that 2 NWA DPS loggerheads will be exposed to noise during pile driving that is loud enough to result in permanent threshold shift (PTS). PTS is auditory injury; therefore, it meets the definition of harm in the context of ESA "take." PTS is expected to consist of minor degradation of hearing capabilities occurring predominantly at the frequencies one-half to one octave above the frequency of the energy produced by pile driving (*i.e*., the low-frequency region below 2 kHz) (Cody and Johnstone, 1981; McFadden, 1986; Finneran, 2015), and not severe hearing impairment. If hearing impairment occurs, it is expected that the affected animal would permanently lose a few decibels in its hearing sensitivity (i.e., a noise would need to be a bit louder, or an animal would need to be closer to it, in order to hear it); severe hearing impairment or total hearing loss is not an expected outcome. As explained above, sea turtles do not vocalize and therefore do not rely on hearing for communication. As with TTS, we expect that the hearing loss associated with PTS may affect the ability of an affected individual to detect acoustic cues that are used to perceive the environment around them. This, in turn, may affect the ability of an affected individual to avoid threats. However, given that we only expect a minor loss of hearing sensitivity and not complete hearing impairment, we do not expect this loss of hearing sensitivity to prevent the affected individuals from detecting and avoiding threats; therefore, it is unlikely that the loggerheads that experience PTS will be less likely to survive than other loggerheads. With this minor degree of PTS, we do not expect it to affect any of the individuals' overall health, reproductive capacity, or survival. The individual experiencing PTS could be less efficient at detecting environmental cues, which could theoretically impact their ability to avoid predators or other threats, but that risk is considered low. For this reason, we do not anticipate that the instances of PTS will result in any other injuries or any impacts on foraging or reproductive success, inclusive of mating and nesting, or survival of the loggerhead that experiences PTS.

The mortality of up to 19 loggerhead sea turtles in the action area over the 43 to 47 year life of the project (inclusive of 5-7 years of construction, 33-35 years of operations, and 5 years of decommissioning) would reduce the number of loggerhead sea turtles from the recovery unit of which they originated as compared to the number of loggerheads that would have been present in the absence of the proposed actions (assuming all other variables remained the same). The Peninsula Florida Recovery Unit and the Northern Recovery Unit represent approximately 87% and 10%, respectively of all nesting effort in the Northwest Atlantic DPS (Ceriani and Meylan 2017, NMFS and USFWS 2008). We expect that the majority of loggerheads in the action area originated from the Northern Recovery Unit (NRU) or the Peninsular Florida Recovery Unit (PFRU).

The Northern Recovery Unit, from the Florida-Georgia border through southern Virginia, is the second largest nesting aggregation in the DPS, with an average of 5,215 nests from 1989-2008, and approximately 1,272 nesting females (NMFS and U.S. FWS 2008). For the Northern recovery unit, nest counts at loggerhead nesting beaches in North Carolina, South Carolina, and

Georgia declined at 1.9% annually from 1983 to 2005 (NMFS and U.S. FWS 2007a). Recently, the trend has been increasing. Ceriani and Meylan (2017) reported a 35% increase for this recovery unit from 2009 through 2013. A longer- term trend analysis based on data from 1983 to 2019 indicates that the annual rate of increase is 1.3 percent (Bolten et al. 2019).

Annual nest totals for the PFRU averaged 64,513 nests from 1989-2007, representing approximately 15,735 females per year (NMFS and USFWS 2008). Nest counts taken at index beaches in Peninsular Florida showed a significant decline in loggerhead nesting from 1989 to 2007, most likely attributed to mortality of oceanic-stage loggerheads caused by fisheries bycatch (Witherington et al. 2009). From 2009 through 2013, a 2 percent decrease for the Peninsular Florida Recovery Unit was reported (Ceriani and Meylan 2017). Using a longer time series from 1989-2018, there was no significant change in the number of annual nests; however, an increase in the number of nests was observed from 2007 to 2018 (Bolten et al. 2019).

The loss of 19 loggerheads over 43 to 47 years of the project represents an extremely small percentage of the number of sea turtles in the PFRU or NRU. Even if the total population of the PFRU was limited to 15,735 loggerheads (the number of nesting females), the loss of 19 individuals would represent approximately 0.12% of the population. If the total NRU population was limited to 1,272 sea turtles (the number of nesting females), and all 19 individuals originated from that population, which is not an expected outcome, the loss of those individuals would represent approximately 1.5% of the population; however, given the distribution of loggerheads from the different nesting beaches, this is an unlikely outcome. Even just considering the number of adult nesting females the loss of 19 individuals over 43 to 47 years is extremely small and would be even smaller when considered for the total recovery unit (i.e., adult nesting females plus males and all younger year classes) and represents an even smaller percentage of the DPS as a whole.

As noted in the *Environmental Baseline*, the status of Northwest Atlantic DPS loggerhead sea turtles in the action area is expected to be the same as that of each recovery unit over the life of the project (stable to increasing). The loss of such a small percentage of the individuals from any of these recovery units represents an even smaller percentage of the DPS as a whole. Considering the extremely small percentage of the populations that will be killed, it is unlikely that these deaths will have a detectable effect on the numbers and population trends of loggerheads in these recovery units or the number of loggerheads in the Northwest Atlantic DPS. We make this conclusion in consideration of the status of the DPSs as a whole, the status of Northwest Atlantic DPS loggerhead sea turtles in the action area, and in consideration of the threats experienced by Northwest Atlantic DPS loggerheads in the action area as described in the *Environmental Baseline* and *Cumulative Effects* sections of this Opinion. As described in section 7.10, climate change may result in changes in the distribution or abundance of Northwest Atlantic DPS loggerheads in the action area over the life of this project; however, we have not identified any different or exacerbated effects of the action in the context of anticipated climate change.

Any effects on reproduction are limited to the future reproductive output of the individuals that die. Even assuming that all of these losses were reproductive female (which is unlikely given the expected even sex ratio in the action area), given the number of nesting adults in each of these populations, it is unlikely that the expected loss of loggerheads would affect the success of nesting in any year. Additionally, this extremely small reduction in potential nesters is expected to result in a similarly small reduction in the number of eggs laid or hatchlings produced in future years and similarly, an extremely small effect on the strength of subsequent year classes with no detectable effect on the trend of any recovery unit or the DPS as a whole. The proposed actions will not affect nesting beaches in any way or disrupt migratory movements in a way that hinders access to nesting beaches or otherwise delays nesting. Additionally, given the small percentage of the species that will be killed as a result of the proposed actions, there is not likely to be any loss of unique genetic haplotypes and no loss of genetic diversity.

The proposed action is not likely to reduce distribution because while the action will temporarily affect the distribution of individual loggerheads through behavioral disturbance changes in distribution will be temporary and limited to movements to nearby areas in the WDA. As explained in Section 7.0 *Effects of the Action*, we expect the project to have insignificant effects on use of the action area by Northwest Atlantic DPS loggerheads.

While generally speaking, the loss of a small number of individuals from a subpopulation or species may have an appreciable reduction on the numbers, reproduction and distribution of the species this is likely to occur only when there are very few individuals in a population, the individuals occur in a very limited geographic range or the species has extremely low levels of genetic diversity. This situation is not likely in the case of this DPS of loggerheads because the DPS is widely geographically distributed, it is not known to have low levels of genetic diversity, there are several thousand individuals in the DPS population and the number of loggerheads in the DPS is likely to be stable or increasing over the time period considered here.

Based on the information provided above, the death of 19 loggerheads over the 43 to 47 year life of the project will not appreciably reduce the likelihood of survival (i.e., it will not decrease the likelihood that the DPS will continue to persist into the future with sufficient resilience to allow for recovery and eventual delisting). The actions will not affect this loggerheads in a way that prevents the DPS from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring and it will not result in effects to the environment which would prevent loggerheads in this DPS from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) the death of 19 loggerheads represents an extremely small percentage of the species as a whole; (2) the death of 19 loggerheads will not change the status or trends of any recovery unit or the DPS as a whole; (3) the loss of 19 loggerheads is not likely to have an effect on the levels of genetic heterogeneity in the population; (4) the loss of 19 loggerheads is likely to have an extremely small effect on reproductive output that will be insignificant at the recovery unit or DPS level; (5) the actions will have only a minor and temporary effect on the distribution of loggerheads in the action area and no effect on the distribution of the DPS throughout its range; and, (6) the actions will have no effect on the ability of loggerheads to shelter and only an insignificant effect on individual foraging loggerheads.

In certain instances, an action may not appreciably reduce the likelihood of a species survival (persistence) but may affect its likelihood of recovery or the rate at which recovery is expected to occur. As explained above, we have determined that the proposed actions will not appreciably reduce the likelihood that this DPS of loggerhead sea turtles will survive in the wild. Here, we consider the potential for the actions to reduce the likelihood of recovery. As noted above, recovery is defined as the improvement in status such that listing is no longer appropriate. Thus, we have considered whether the proposed actions will affect the likelihood that the NWA DPS of loggerheads can rebuild to a point where listing is no longer appropriate. In 2008, NMFS and the USFWS issued a recovery plan for the Northwest Atlantic population of loggerheads (NMFS and USFWS 2008). The plan includes demographic recovery criteria as well as a list of tasks that must be accomplished. Demographic recovery criteria are included for each of the five recovery units. These criteria focus on sustained increases in the number of nests laid and the number of nesting females in each recovery unit, an increase in abundance on foraging grounds, and ensuring that trends in neritic strandings are not increasing at a rate greater than trends in in-water abundance. The recovery tasks focus on protecting habitats, minimizing and managing predation and disease, and minimizing anthropogenic mortalities.

Loggerheads have a stable trend; as explained above, the loss of 19 NWA DPS loggerheads over the life span of the proposed actions will not affect the population trend. The number of loggerheads likely to die as a result of the proposed actions is an extremely small percentage of any recovery unit or the DPS as a whole. This loss will not affect the likelihood that the population will reach the size necessary for recovery or the rate at which recovery will occur. As such, the proposed actions will not affect the likelihood that the demographic criteria will be achieved or the timeline on which they will be achieved. The action area does not include nesting beaches; all effects to habitat will be insignificant or extremely unlikely to occur; therefore, the proposed actions will have no effect on the likelihood that habitat based recovery criteria will be achieved. The proposed actions will also not affect the ability of any of the recovery tasks to be accomplished.

The effects of the proposed actions will not hasten the extinction timeline or otherwise increase the danger of extinction; further, the actions will not prevent this DPS of the species from growing in a way that leads to recovery and the actions will not change the rate at which recovery can occur. This is the case because while the actions may result in a small reduction in the number of loggerheads and a small reduction in the amount of potential reproduction due to the loss of these individuals, these effects will be undetectable over the long-term and the actions are not expected to have long term impacts on the future growth of the DPS or its potential for recovery. Therefore, based on the analysis presented above, the proposed actions will not appreciably reduce the likelihood that the NWA DPS of loggerhead sea turtles can be brought to the point at which their listing as threatened or endangered is no longer appropriate; that is, the proposed action will not appreciably reduce the likelihood of recovery of the NWA DPS of loggerhead sea turtles.

Based on the analysis presented herein, the effects of the proposed action are not likely to appreciably reduce the likelihood of both the survival and recovery of the NWA DPS of loggerhead sea turtles. These conclusions were made in consideration of the threatened status of NWA DPS loggerhead sea turtles, the effects of the action, other stressors that individuals are exposed to within the action area as described in the *Environmental Baseline* and *Cumulative Effects*, and any anticipated effects of climate change on the abundance, reproduction, and distribution of loggerhead sea turtles in the action area.

9.3.2 North Atlantic DPS of Green Sea Turtles

The North Atlantic DPS of green sea turtles is listed as threatened under the ESA. As described in the *Status of the Species*, the North Atlantic DPS of green sea turtles is the largest of the 11 green turtle DPSs with an estimated abundance of over 167,000 adult females from 73 nesting sites. All major nesting populations demonstrate long-term increases in abundance (Seminoff et al. 2015b). Green sea turtles face numerous threats on land and in the water that affect the survival of all age classes. While the threats of pollution, habitat loss through coastal development, beachfront lighting, and fisheries bycatch continue for this DPS, the DPS appears to be somewhat resilient to future perturbations. As described in the *Environmental Baseline* and *Cumulative Effects*, North Atlantic DPS green sea turtles in the action area are exposed to pollution and experience vessel strike and fisheries bycatch. As noted in the *Cumulative Effects* section of this Opinion, we have not identified any cumulative effects different from those considered in the *Status of the Species* and *Environmental Baseline* sections of this Opinion, inclusive of how those activities may contribute to climate change. As described in Section 7.10, climate change may result in changes in the distribution or abundance of North Atlantic DPS green sea turtles in the action area over the life of this project; however, we have not identified any different or exacerbated effects of the action in the context of anticipated climate change.

There are four regions that support high nesting concentrations in the North Atlantic DPS: Costa Rica (Tortuguero), Mexico (Campeche, Yucatan, and Quintana Roo), United States (Florida), and Cuba. Using data from 48 nesting sites in the North Atlantic DPS, nester abundance was estimated at 167,528 total nesters (Seminoff et al. 2015). The years used to generate the estimate varied by nesting site but were between 2005 and 2012. The largest nesting site (Tortuguero, Costa Rica) hosts 79 percent of the estimated nesting. It should be noted that not all female turtles nest in a given year (Seminoff et al. 2015). Nesting in the area has increased considerably since the 1970s, and nest count data from 1999-2003 suggested that 17,402-37,290 females nested there per year (Seminoff et al. 2015). In 2010, an estimated 180,310 nests were laid at Tortuguero, the highest level of green sea turtle nesting estimated since the start of nesting track surveys in 1971. This equated to somewhere between 30,052 and 64,396 nesters in 2010 (Seminoff et al. 2015). Nesting sites in Cuba, Mexico, and the United States were either stable or increasing (Seminoff et al. 2015). More recent data is available for the southeastern United States. Nest counts at Florida's core index beaches have ranged from less than 300 to almost 61,000 in 2023. The Index Nesting Beach Survey (INBS) is carried out on a subset of beaches surveyed during the Statewide Nesting Beach Survey (SNBS) and is designed to measure trends in nest numbers. The nest trend in Florida shows the typical biennial peaks in abundance and has been increasing (https://myfwc.com/research/wildlife/sea- turtles/nesting/beach-survey-totals/). The SNBS is broader but is not appropriate for evaluating trends. In 2023, over 77,000 green turtle nests were counted in Florida, which was a record high. (https://myfwc.com/research/wildlife/sea-turtles/nesting/). Seminoff et al. (2015) estimated total nester abundance for Florida at 8,426 turtles.

NMFS recognizes that the nest count data available for green sea turtles in the Atlantic indicates increased nesting at many sites. However, we also recognize that the nest count data, including data for green sea turtles in the Atlantic, only provides information on the number of females currently nesting, and is not necessarily a reflection of the number of mature females available to nest or the number of immature females that will reach maturity and nest in the future.

The impacts to green sea turtles from the proposed action are expected to result in the harassment (significant disruption of behavioral patterns, inclusive of TTS and behavioral disturbance) of 2 individuals due to exposure to pile driving noise; the mortality of 2 individuals due to vessel strike over the 43 to 47-year life of the project inclusive of construction, operations, and decommissioning; and, the capture of up to 1 green sea turtle in the trawl surveys, we expect this individual will be released alive with only minor, recoverable injuries (minor scrapes and abrasions). We determined that all other effects of the action would be insignificant or extremely unlikely. In total, we anticipate the proposed action will result in the mortality of two North Atlantic DPS green sea turtles over the 43 to 47-year life of the project.

The 2 green sea turtles that experience harassment would experience behavioral disturbance and could suffer temporary hearing impairment (TTS); we also expect these turtles would experience physiological stress during the period that their normal behavioral patterns are disrupted (i.e., a period of several days). Aversion/avoidance behavior would be limited to the short period of time the animal is exposed to pile driving noise; TTS and associated disruptions to normal behavioral patterns (migrating, resting, feeding) will persist for a few days but are not expected to be experienced for more than a week. Any sea turtle affected by TTS would experience a temporary, recoverable, hearing loss manifested as a threshold shift around the frequency of the pile driving noise. Sea turtles are not known to depend heavily on acoustic cues for vital biological functions (Nelms et al. 2016; Popper et al. 2014), and instead, may rely primarily on senses other than hearing for interacting with their environment, such as vision and magnetic orientation (Avens and Lohmann 2003; Putman et al. 2015). Because sea turtles do not vocalize or use noise to communicate, any TTS would not impact communications. However, to the extent that sea turtles do rely on acoustic cues from their environment, we expect that this temporary hearing impairment would affect frequencies utilized by sea turtles for acoustic cues such as the sound of waves, coastline noise, or the presence of a vessel or predator (Narazaki et al. 2013). If such cues increase survivorship (e.g., aid in avoiding predators, navigation), temporary loss of hearing sensitivity may have effects on the ability of a sea turtle to avoid threats which could decrease its ability to avoid those threats; this would be a significant disruption of behavioral patterns that creates the likelihood of injury. TTS of sea turtles is expected to only last for several days following the initial exposure (Moein et al. 1994). Given this short period of time, and that sea turtles are not known to rely heavily on acoustic cues, while TTS may impact the ability of affected individuals to avoid threats during the few days that TTS is experienced, we do not anticipate single TTSs would have any long-term impacts on the health or reproductive capacity or success of individual sea turtles.

The energetic consequences of avoidance/aversion behavior and any associated delay in resting or foraging will be disruptive for the period of time that the individual is exposed to the noise source. Similar effects are likely to be experienced in the period before the animal recovers from TSS. However, the limited duration means that these consequences are not expected to affect any individual's ability to successfully obtain enough food to maintain their health, or impact the ability of any individual to make seasonal migrations or participate in breeding or nesting. As a result of the energetic costs, evasive behaviors, and temporary impact on the ability to detect environmental cues which could affect the ability to avoid threats, TTS and behavioral disruption will create or increase the risk of injury for the affected sea turtles compared to those that are not exposed to these noise sources. However, as established herein, the temporary and limited nature of these effects means that it is unlikely that the behavioral disruption and temporary loss of hearing sensitivity would affect an individual sea turtle's fitness (i.e., survival or reproduction). As explained in Section 7.2 of this Opinion, we determined that effects to these 2 green sea turtles meet NMFS interim definition of harassment but not the definition of harm.

The death of two NA DPS green sea turtle, whether a male or female, immature or mature, would reduce the number of green sea turtles as compared to the number of green that would have been present in the absence of the proposed actions assuming all other variables remained the same. The loss of one green sea turtle represents a very small percentage of the DPS as a whole. Even compared to the number of nesting females (17,000-37,000), which represent only a portion of the number of greens worldwide, the mortality of two green sea turtles represents less than 0.01% of the DPS's nesting population. The loss of this sea turtle would be expected to reduce the reproduction of green sea turtles as compared to the reproductive output of green sea turtles in the absence of the proposed action. As described in the *Status of the Species* section above, we consider the trend for green sea turtles to be stable. As noted in the Environmental Baseline, the status of green sea turtles in the action area is expected to be the same as that of each recovery unit over the life of the project. As explained below, the death of this green sea turtle will not appreciably reduce the likelihood of survival for this DPS of the species for the reasons outlined below. We make this conclusion in consideration of the status of the species as a whole, the status of green sea turtles in the action area, and in consideration of the threats experienced by green sea turtles in the action area as described in the *Environmental Baseline* and *Cumulative Effects* sections of this Opinion.

While generally speaking, the loss of a small number of individuals from a subpopulation or species may have an appreciable reduction on the numbers, reproduction and distribution of the species this is likely to occur only when there are very few individuals in a population, the individuals occur in a very limited geographic range or the species has extremely low levels of genetic diversity. This situation is not likely in the case of greens because: this DPS of the species is widely geographically distributed, it is not known to have low levels of genetic diversity, there are several thousand individuals in the population and the number of greens is likely to be increasing and at worst is stable. These actions are not likely to reduce distribution of greens because the actions will not cause more than a temporary disruption to foraging and migratory behaviors.

Based on the information provided above, the death of two NA DPS green sea turtles over the 43 to 47-year life of the project, will not appreciably reduce the likelihood of survival (i.e., it will not decrease the likelihood that this DPS of the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment). The action will not affect green sea turtles in a way that prevents this DPS of the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring and it will not result in effects to the environment which would prevent green sea turtles from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) the DPS for this species' nesting trend is increasing; (2) the death of 2 green sea turtles represents an extremely small percentage of the DPS as a whole; (3) the loss of 2 green sea turtles will not change the status or trends of the DPS as a whole; (4) the loss of 2 green sea turtles is not likely to have an effect on the levels of genetic heterogeneity in the population; (5) the loss of 2 green sea turtles is likely to have an undetectable effect on reproductive output of the DPS as a whole; (6) the action will have insignificant and temporary effects on the distribution of greens in the action area and no effect on its distribution throughout the DPS's range; and (7) the action will have no effect on the ability of green sea turtles to shelter and only an insignificant effect on individual foraging green sea turtles.

In rare instances, an action may not appreciably reduce the likelihood of a species survival (persistence) but may affect its likelihood of recovery or the rate at which recovery is expected to occur. As explained above, we have determined that the proposed actions will not appreciably reduce the likelihood that this DPS of green sea turtles will survive in the wild. Here, we consider the potential for the actions to reduce the likelihood of recovery. As noted above, recovery is defined as the improvement in status such that listing is no longer appropriate. Thus, we have considered whether the proposed actions will affect the likelihood that this DPS of the species can rebuild to a point where listing is no longer appropriate. A Recovery Plan for Green sea turtles was published by NMFS and USFWS in 1991. The plan outlines the steps necessary for recovery and the criteria, which, once met, would ensure recovery. In order to be delisted, green sea turtles must experience sustained population growth, as measured in the number of nests laid per year, over time. Additionally, "priority one" recovery tasks must be achieved, nesting habitat must be protected (through public ownership of nesting beaches), and stage class mortality must be reduced.

The proposed actions will not appreciably reduce the likelihood of survival or recovery of green sea turtles in this DPS. Also, it is not expected to modify, curtail or destroy the range of the DPS since it will result in an extremely small reduction in the number of green sea turtles in any geographic area and since it will not affect the overall distribution of green sea turtles other than to cause minor temporary adjustments in movements in the action area. As explained above, the proposed actions are likely to result in the mortality of one green sea turtle; however, as explained above, the loss of this individual over this time period is not expected to affect the persistence of green sea turtles or the trend for this DPS of the species. The actions will not affect nesting habitat and will have only an extremely small effect on mortality. The effects of the proposed actions will not hasten the extinction timeline or otherwise increase the danger of extinction; further, the actions will not prevent this DPS of the species from growing in a way that leads to recovery, and the actions will not change the rate at which recovery can occur. This is the case because while the actions may result in a small reduction in the number of greens and a small reduction in the amount of potential reproduction due to the loss of one individual, these effects will be undetectable over the long-term, and the action is not expected to have long term impacts on the future growth of the population or its potential for recovery. Therefore, based on the analysis presented above, the proposed actions will not appreciably reduce the likelihood that green sea turtles in this DPS can be brought to the point at which their listing as endangered or threatened is no longer appropriate; that is, the proposed action will not appreciably reduce the likelihood of recovery of this DPS of green sea turtles.

Despite the threats faced by individual NA DPS green sea turtles inside and outside of the action area, the proposed actions will not increase the vulnerability of individual sea turtles to these additional threats and exposure to ongoing threats will not increase susceptibility to effects related to the proposed actions. We have considered the effects of the proposed actions in light of the status of the DPS of the species rangewide and in the action area, the environmental baseline, cumulative effects explained above, including climate change, and have concluded that even in light of the ongoing impacts of these activities and conditions, the conclusions reached above do not change.

Based on the analysis presented herein, the effects the proposed actions are not likely to appreciably reduce the likelihood of both the survival and recovery of the North Atlantic DPS of green sea turtles. These conclusions were made in consideration of the threatened status of the North Atlantic DPS of green sea turtles, the effects of the action, other stressors that individuals are exposed to within the action area as described in the *Environmental Baseline* and *Cumulative Effects*, and any anticipated effects of climate change on the abundance, reproduction, and distribution of NA DPS green sea turtles in the action area.

9.3.3 Leatherback Sea Turtles

Leatherback sea turtles are listed as endangered under the ESA. Leatherbacks are widely distributed throughout the oceans of the world and are found in waters of the Atlantic, Pacific, and Indian Oceans, the Caribbean Sea, Mediterranean Sea, and the Gulf of Mexico (Ernst and Barbour 1972). Leatherback nesting occurs on beaches of the Atlantic, Pacific, and Indian Oceans as well as in the Caribbean (NMFS and USFWS 2013). Leatherbacks face a multitude of threats that can cause death prior to and after reaching maturity. Some activities resulting in leatherback mortality have been addressed.

The most recent published assessment, the leatherback status review, estimated that the total index of nesting female abundance for the Northwest Atlantic population of leatherbacks is 20,659 females (NMFS and USFWS 2020). This abundance estimate is similar to other estimates. The TEWG estimate approximately 18,700 (range 10,000 to 31,000) adult females using nesting data from 2004 and 2005 (TEWG 2007). The IUCN Red List assessment for the NW Atlantic Ocean subpopulation estimated 20,000 mature individuals (male and female) and approximately 23,000 nests per year (data through 2017) with high inter-annual variability in annual nest counts within and across nesting sites (Northwest Atlantic Leatherback Working Group 2019). The estimate in the status review is higher than the estimate for the IUCN Red List assessment, likely due to a different remigration interval, which has been increasing in recent years (NMFS and USFWS 2020). For this analysis, we found that the status review estimate of 20,659 nesting females represents the best available scientific information given that it uses the most comprehensive and recent demographic trends and nesting data.

In the 2020 status review, the authors identified seven leatherback populations that met the discreteness and significance criteria of DPSs (NMFS and USFWS 2020). These include the Northwest Atlantic, Southwest Atlantic, Southeast Atlantic, Southwest Indian, Northeast Indian, West Pacific, and East Pacific. The population found within the action is area is that identified in the status review as the Northwest Atlantic DPS. While NMFS and USFWS concluded that seven populations met the criteria for DPSs, the species continues to be listed at the global level (85 FR 48332, August 10, 2020) as the agencies have taken no action to list one or more DPSs. Therefore, while we reference the DPSs and stocks to analyze the status and trends of various populations, our jeopardy analysis is based on the range-wide status of the species as listed.

Previous assessments of leatherbacks concluded that the Northwest Atlantic population was stable or increasing (TEWG 2007, Tiwari et al. 2013b). However, as described in the *Status of the Species*, more recent analyses indicate that the overall trends are negative (NMFS and USFWS 2020, Northwest Atlantic Leatherback Working Group 2018, 2019). At the stock level, the Working Group evaluated the NW Atlantic – Guianas-Trinidad, Florida, Northern Caribbean, and the Western Caribbean stocks. The NW Atlantic – Guianas-Trinidad stock is the largest stock and declined significantly across all periods evaluated, which was attributed to an exponential decline in abundance at Awala-Yalimapo, French Guiana as well as declines in Guyana; Suriname; Cayenne, French Guiana; and Matura, Trinidad. Declines in Awala-Yalimapo were attributed, in part, due to beach erosion and a loss of nesting habitat (Northwest Atlantic Leatherback Working Group 2018). The Florida stock increased significantly over the long-term, but declined from 2008-2017 (Northwest Atlantic Leatherback Working Group 2018). An increasing trend in nest counts in Florida have been observed in 2018 through 2023; however, nest counts remain low compared to 2008-2015 (https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey- totals/). The Northern Caribbean and Western Caribbean stocks have also declined. The Working Group report also includes trends at the site-level, which varied depending on the site and time period, but were generally negative especially in the recent period.

Similarly, the leatherback status review concluded that the Northwest Atlantic DPS exhibits decreasing nest trends at nesting aggregations with the greatest indices of nesting female abundance. Though some nesting aggregations indicated increasing trends, most of the largest ones are declining. This trend is considered to be representative of the DPS (NMFS and USFWS 2020). Data also indicated that the Southwest Atlantic DPS is declining (NMFS and USFWS 2020).

Populations in the Pacific have shown dramatic declines at many nesting sites (Mazaris et al. 2017, Santidrián Tomillo et al. 2017, Santidrián Tomillo et al. 2007, Sarti Martínez et al. 2007, Tapilatu et al. 2013). The IUCN Red List assessment estimated the number of total mature individuals (males and females) at Jamursba-Medi and Wermon beaches to be 1,438 turtles (Tiwari et al. 2013a). More recently, the leatherback status review estimated the total index of nesting female abundance of the West Pacific DPS at 1,277 females for the West Pacific DPS and 755 females for the East Pacific DPS (NMFS and USFWS 2020). The East Pacific DPS has exhibited a decreasing trend since monitoring began with a 97.4 percent decline since the 1980s or 1990s, depending on nesting beach (Wallace et al. 2013). Population abundance in the Indian Ocean is difficult to assess due to lack of data and inconsistent reporting. Most recently, the 2020 status review estimated that the total index of nesting female abundance for the SW Indian DPS is 149 females and that the DPS is exhibiting a slight decreasing nest trend (NMFS and USFWS 2020). While data on nesting in the Northeast Indian Ocean DPS is limited, the DPS is estimated at 109 females. This DPS has exhibited a drastic population decline with extirpation of the largest nesting aggregation in Malaysia (NMFS and USFWS 2020).

The primary threats to leatherback sea turtles include fisheries bycatch, harvest of nesting females, and egg harvesting; of these, as described in the *Environmental Baseline* and

Cumulative Effects, fisheries bycatch occurs in the action area. Leatherback sea turtles in the action area are also at risk of vessel strike. As noted in the *Cumulative Effects* section of this Opinion, we have not identified any cumulative effects different from those considered in the *Status of the Species* and *Environmental Baseline* sections of this Opinion, inclusive of how those activities may contribute to climate change. As described in Section 7.10, climate change may result in changes in the distribution or abundance of leatherback sea turtles in the action area over the life of this project; however, we have not identified any different or exacerbated effects of the action in the context of anticipated climate change.

The impacts to leatherback sea turtles from the proposed action are expected to result in the harassment (inclusive of TTS and behavioral disturbance) of 14 individuals due to exposure to pile driving noise and UXO detonation (13 pile driving, 1 UXO) and harm (PTS) of 5 individuals as a result of exposure to pile driving noise. We also expect that 19 leatherbacks will be struck and killed by a project vessel over the 43 to 47-year life of the project inclusive of construction, operations, and decommissioning. We do not expect the capture of any leatherbacks in the trawl surveys. We determined that all other effects of the action would be insignificant or extremely unlikely to occur. In total, we anticipate the proposed action will result in the mortality of 19 leatherback sea turtles over the 43 to 47-year life of the project.

The 14 leatherback sea turtles that experience harassment would experience behavioral disturbance and could suffer temporary hearing impairment (TTS); we also expect these turtles would experience physiological stress during the period that their normal behavioral patterns are disrupted (i.e., a period of several days). Aversion/avoidance behavior would be limited to the short period of time the animal is exposed to pile driving noise; TTS and associated disruptions to normal behavioral patterns (migrating, resting, feeding) will persist for a few days but are not expected to be experienced for more than a week. Any sea turtles affected by TTS would experience a temporary, recoverable, hearing loss manifested as a threshold shift around the frequency of the pile driving detonation noise (as relevant for the exposure). Sea turtles are not known to depend heavily on acoustic cues for vital biological functions (Nelms et al. 2016; Popper et al. 2014), and instead, may rely primarily on senses other than hearing for interacting with their environment, such as vision and magnetic orientation (Avens and Lohmann 2003; Putman et al. 2015). Because sea turtles do not vocalize or use noise to communicate, any TTS would not impact communications. However, to the extent that sea turtles do rely on acoustic cues from their environment, we expect that this temporary hearing impairment would affect frequencies utilized by sea turtles for acoustic cues such as the sound of waves, coastline noise, or the presence of a vessel or predator (Narazaki et al. 2013). If such cues increase survivorship (e.g., aid in avoiding predators, navigation), temporary loss of hearing sensitivity may have effects on the ability of a sea turtle to avoid threats which could decrease its ability to avoid those threats; this would be a significant disruption of behavioral patterns that creates the likelihood of injury. TTS of sea turtles is expected to only last for several days following the initial exposure (Moein et al. 1994). Given this short period of time, and that sea turtles are not known to rely heavily on acoustic cues, while TTS may impact the ability of affected individuals to avoid threats during the few days that TTS is experienced, we do not anticipate single TTSs would have any long-term impacts on the health or reproductive capacity or success of individual sea turtles.

The energetic consequences of avoidance/aversion behavior and any associated delay in resting or foraging will be disruptive for the period of time that the individual is exposed to the noise source. Similar effects are likely to be experienced in the period before the animal recovers from TSS. However, the limited duration means that these consequences are not expected to affect any individual's ability to successfully obtain enough food to maintain their health, or impact the ability of any individual to make seasonal migrations or participate in breeding or nesting. As a result of the energetic costs, evasive behaviors, and temporary impact on the ability to detect environmental cues which could affect the ability to avoid threats, TTS and behavioral disruption will create or increase the risk of injury for the affected sea turtles compared to those that are not exposed to these noise sources. However, as established herein, the temporary and limited nature of these effects means that it is unlikely that the behavioral disruption and temporary loss of hearing sensitivity would affect an individual sea turtle's fitness (i.e., survival or reproduction). As explained in Section 7.2 of this Opinion, we determined that effects to these 14 leatherback sea turtles meet NMFS interim definition of harassment but not the definition of harm.

We expect 5 leatherback will be exposed to noise during pile driving that is loud enough to result in permanent threshold shift (PTS). PTS is auditory injury; therefore, it meets the definition of harm in the context of ESA "take." PTS is expected to consist of minor degradation of hearing capabilities occurring predominantly at the frequencies one-half to one octave above the frequency of the energy produced by pile driving (*i.e*., the low-frequency region below 2 kHz) (Cody and Johnstone, 1981; McFadden, 1986; Finneran, 2015), and not severe hearing impairment. If hearing impairment occurs, it is expected that the affected animal would permanently lose a few decibels in its hearing sensitivity (i.e., a noise would need to be a bit louder, or an animal would need to be closer to it, in order to hear it); severe hearing impairment or total hearing loss is not an expected outcome. As explained above, sea turtles do not vocalize and therefore do not rely on hearing for communication. As with TTS, we expect that the hearing loss associated with PTS may affect the ability of an affected individual to detect acoustic cues that are used to perceive the environment around them. This, in turn, may affect the ability of an affected individual to avoid threats. However, given that we only expect a minor loss of hearing sensitivity and not complete hearing impairment, we do not expect this loss of hearing sensitivity to prevent the affected individuals from detecting and avoiding threats; therefore, it is unlikely that the leatherbacks that experience PTS will be less likely to survive than other leatherbacks. With this minor degree of PTS, we do not expect it to affect the affected individuals' overall health, reproductive capacity, or survival. The individual leatherback could be less efficient at detecting environmental cues, which could theoretically impact their ability to avoid predators or other threats, but that risk is considered low. For this reason, we do not anticipate that the single instance of PTS to one individual will result in any other injuries or any impacts on foraging or reproductive success, inclusive of mating and nesting, or survival.

The death of 19 leatherbacks over the life span of the project represents an extremely small percentage of the number of leatherbacks in the North Atlantic, just 0.09% even considering the lowest population estimate of nesting females (20,659; NMFS and USFWS 2020) and an even smaller percentage of the species as a whole. Considering the extremely small percentage of the population that will be killed, it is unlikely that this death will have a detectable effect on the numbers and population trends of leatherbacks in the North Atlantic or the species as a whole.

Any effects on reproduction are limited to the future reproductive output of the individual killed. Even assuming that the mortality is to a reproductive female, given the number of nesting females in this population (20,659), it is unlikely that the expected loss of no more than 19 leatherbacks over 43 to 47 years would affect the success of nesting in any year. Additionally, this extremely small reduction in a potential nester is expected to result in a similarly small reduction in the number of eggs laid or hatchlings produced in future years and similarly, an extremely small effect on the strength of subsequent year classes with no detectable effect on the trend of any nesting beach or the population as a whole. The proposed action will not affect nesting beaches in any way or disrupt migratory movements in a way that hinders access to nesting beaches or otherwise delays nesting. Additionally, given the small percentage of the species that will be killed as a result of the proposed action, there is not likely to be any loss of unique genetic haplotypes and no loss of genetic diversity.

The proposed action is not likely to reduce distribution because while the action will temporarily affect the distribution of individual leatherbacks through behavioral disturbance, changes in distribution will be temporary and limited to movements to nearby areas in the WDA. As explained in Section 7.0 *Effects of the Action*, we expect the project to have insignificant effects on use of the action area by leatherbacks.

While generally speaking, the loss of a small number of individuals from a subpopulation or species may have an appreciable reduction on the numbers, reproduction and distribution of the species this is likely to occur only when there are very few individuals in a population, the individuals occur in a very limited geographic range or the species has extremely low levels of genetic diversity. This situation is not likely in the case of leatherbacks because: the species is widely geographically distributed, it is not known to have low levels of genetic diversity, there are several thousand individuals in the population and the number of leatherbacks is likely to be stable or increasing over the period considered here.

Based on the information provided above, the death of 19 leatherbacks over the 43 to 47-year life of the project will not appreciably reduce the likelihood of survival (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for recovery and eventual delisting). The actions will not affect leatherbacks in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring and it will not result in effects to the environment which would prevent leatherbacks from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) the death of 19 leatherbacks represents an extremely small percentage of the Northwest Atlantic population and an even smaller percentage of the species as a whole; (2) the death of 19 leatherbacks will not change the status or trends of any nesting beach, the Northwest Atlantic population or the species as a whole; (3) the loss of 19 leatherback is not likely to have an effect on the levels of genetic heterogeneity in the population; (4) the loss of 19 leatherbacks is likely to have an extremely small effect on reproductive output that will be insignificant at the nesting beach, population, or species level; (5) the actions will have only a minor and temporary effect on the distribution of leatherbacks in the action area and no effect on the distribution of the species throughout its range; and, (6) the actions will have no effect on the ability of leatherbacks to shelter and only an insignificant effect on individual foraging leatherbacks.

In certain instances, an action may not appreciably reduce the likelihood of a species survival (persistence) but may affect its likelihood of recovery or the rate at which recovery is expected to occur. As explained above, we have determined that the proposed actions will not appreciably reduce the likelihood that leatherback sea turtles will survive in the wild. Here, we consider the potential for the actions to reduce the likelihood of recovery. As noted above, recovery is defined as the improvement in status such that listing is no longer appropriate. Thus, we have considered whether the proposed actions will affect the likelihood that leatherbacks can rebuild to a point where listing is no longer appropriate. In 1992, NMFS and the USFWS issued a recovery plan for leatherbacks in the U.S. Caribbean, Atlantic, and Gulf of Mexico (NMFS and USFWS 1992). The plan includes three recovery objectives:

1) The adult female population increases over the next 25 years, as evidenced by a statistically significant trend in the number of nests at Culebra, Puerto Rico, St. Croix, USVI, and along the east coast of Florida.

2) Nesting habitat encompassing at least 75 percent of nesting activity in USVI, Puerto Rico and Florida is in public ownership.

3) All priority one tasks have been successfully implemented.

The recovery tasks focus on protecting habitats, minimizing and managing predation and disease, and minimizing anthropogenic mortalities.

Because the death of 19 leatherbacks over the 43 to 47-year life of the project is such a small percentage of the population and is not expected to affect the status or trend of the species, it will not affect the likelihood that the adult female population of loggerheads increases over time. This loss will not affect the likelihood that the population will reach the size necessary for recovery or the rate at which recovery will occur. As such, the proposed actions will not affect the likelihood that the demographic criteria will be achieved or the timeline on which they will be achieved. The action area does not include nesting beaches; all effects to habitat will be insignificant or extremely unlikely to occur; therefore, the proposed actions will have no effect on the likelihood that habitat based recovery criteria will be achieved. The proposed actions will also not affect the ability of any of the recovery tasks to be accomplished.

The effects of the proposed actions will not hasten the extinction timeline or otherwise increase the danger of extinction; further, the actions will not prevent the species from growing in a way that leads to recovery and the actions will not change the rate at which recovery can occur. This is the case because while the actions may result in a small reduction in the number of leatherbacks and a small reduction in the amount of potential reproduction due to the loss of these individual, these effects will be undetectable over the long-term and the actions are not expected to have long term impacts on the future growth of the species or its potential for recovery. Therefore, based on the analysis presented above, the proposed actions will not appreciably reduce the likelihood that leatherback sea turtles can be brought to the point at which they are no longer listed as endangered Despite the threats faced by individual leatherback sea turtles inside and outside of the action area, the proposed actions will not increase the vulnerability of individual sea turtles to these additional threats and exposure to ongoing threats will not increase susceptibility to effects related to the proposed actions. We have considered the effects of the proposed actions in light of the status of the species rangewide and in the action area, the environmental baseline, cumulative effects explained above, including climate change, and have concluded that even in light of the ongoing impacts of these activities and conditions; the conclusions reached here do not change.

Based on the analysis presented herein, the proposed actions are not likely to appreciably reduce the survival and recovery of leatherback sea turtles. These conclusions were made in consideration of the endangered status of leatherback sea turtles, other stressors that individuals are exposed to within the action area as described in the *Environmental Baseline* and *Cumulative Effects*, and any anticipated effects of climate change on the abundance and distribution of leatherback sea turtles in the action area; that is, the proposed action will not appreciably reduce the likelihood of recovery of leatherback sea turtles.

Despite the threats faced by individual leatherback sea turtles inside and outside of the action area, the proposed actions will not increase the vulnerability of individual sea turtles to these additional threats and exposure to ongoing threats will not increase susceptibility to effects related to the proposed actions. We have considered the effects of the proposed actions in light of the status of the species rangewide and in the action area, the environmental baseline, cumulative effects explained above, including climate change, and have concluded that even in light of the ongoing impacts of these activities and conditions, the conclusions reached above do not change.

Based on the analysis presented herein, the effects of the proposed action are not likely to appreciably reduce the likelihood of both the survival and recovery of leatherback sea turtles. These conclusions were made in consideration of the endangered status of leatherback sea turtles, the effects of the action, other stressors that individuals are exposed to within the action area as described in the *Environmental Baseline* and *Cumulative Effects*, and any anticipated effects of climate change on the abundance, reproduction, and distribution of leatherback sea turtles in the action area.

9.3.4 Kemp’s Ridley Sea Turtles

Kemp’s ridley sea turtles are listed as a single species classified as endangered under the ESA. They occur in the Atlantic Ocean and Gulf of Mexico, the only major nesting site for Kemp’s ridleys is a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Carr 1963, NMFS and USFWS 2015, USFWS and NMFS 1992).

Nest count data provides the best available information on the number of adult females nesting each year. As is the case with other sea turtles species, nest count data must be interpreted with caution given that these estimates provide a minimum count of the number of nesting Kemp’s ridley sea turtles. In addition, the estimates do not account for adult males or juveniles of either sex. Without information on the proportion of adult males to females and the age structure of the population, nest counts cannot be used to estimate the total population size (Meylan 1982, Ross 1996). Nevertheless, the nesting data does provide valuable information on the extent of Kemp’s ridley nesting and the trend in the number of nests laid. It is the best proxy we have for estimating population changes.

Following a significant, unexplained one-year decline in 2010, Kemp's ridley sea turtle nests in Mexico reached a record high of 21,797 in 2012 (Gladys Porter Zoo nesting database, unpublished data). In 2013 and 2014, there was a second significant decline in Mexico nests, with only 16,385 and 11,279 nests recorded, respectively. In 2015, nesting in Mexico improved to 14,006 nests, and in 2016 overall numbers increased to 18,354 recorded nests. There was a record high nesting season in 2017, with 24,570 nests recorded (J. Pena, pers. comm. to NMFS SERO PRD, August 31, 2017 as cited in NMFS 2020) and decreases observed in 2018 and again in 2019 (Figure 39). In 2019, there were 11,140 nests in Mexico. It is unknown whether this decline is related to resource fluctuation, natural population variability, effects of catastrophic events like the Deepwater Horizon oil spill affecting the nesting cohort, or some other factor. A small nesting population is also emerging in the United States, primarily in Texas. From 1980-1989, there were an average of 0.2 nests/year at Padre Island National Seashore (PAIS), rising to 3.4 nests/year from 1990-1999, 44 nests/year from 2000-2009, and 110 nests per year from 2010-2019. There was a record high of 353 nests in 2017 (NPS 2020). In 2023, there were 256 Kemp's ridley nests counted, down from 284 in 2022. It is worth noting that nesting in Texas has paralleled the trends observed in Mexico, characterized by a significant decline in 2010, followed by a second decline in 2013-2014, but with a rebound in 2015-2017 (NMFS 2020c) and decreases in nesting in 2018 and 2019 (NPS 2020).

Estimates of the adult female nesting population reached a low of approximately 250-300 in 1985 (NMFS and USFWS 2015, TEWG 2000). Gallaway et al. (2016) developed a stock assessment model for Kemp's ridley to evaluate the relative contributions of conservation efforts and other factors toward this species' recovery. Terminal population estimates for 2012 summed over ages 2 to 4, ages 2+, ages 5+, and ages 9+ suggest that the respective female population sizes were 78,043 (SD = 14,683), 152,357 (SD = 25,015), 74,314 (SD =10,460), and 28,113 (SD = 2,987) (Gallaway et al. 2016). Using the standard IUCN protocol for sea turtle assessments, the number of mature individuals was recently estimated at 22,341 (Wibbels and Bevan 2019). The calculation took into account the average annual nests from 2016-2018 (21,156), a clutch frequency of 2.5 per year, a remigration interval of 2 years, and a sex ratio of 3.17 females: 1 male. Based on the data in their analysis, the assessment concluded the current population trend is unknown (Wibbels and Bevan 2019). However, some positive outlooks for the species include recent conservation actions, including the expanded TED requirements in the shrimp fishery (84 FR 70048, December 20, 2019) and a decrease in the amount of shrimping off the coast of Tamaulipas and in the Gulf of Mexico (NMFS and USFWS 2015).

Genetic variability in Kemp's ridley turtles is considered to be high, as measured by nuclear DNA analyses (i.e., microsatellites) (NMFS et al. 2011). If this holds true, then rapid increases in population over one or two generations would likely prevent any negative consequences in the genetic variability of the species (NMFS et al. 2011). Additional analysis of the mtDNA taken from samples of Kemp's ridley turtles at Padre Island, Texas, showed six distinct haplotypes, with one found at both Padre Island and Rancho Nuevo (Dutton et al. 2006).

Fishery interactions are the main threat to the species. The species' limited range and low global abundance make its resilience to future perturbation low. The status of Kemp's ridley sea turtles in the action area is the same as described in the Status of the Species. As described in the *Environmental Baseline* and *Cumulative Effects*, fisheries bycatch and vessel strike are likely to continue to occur in the action area over the life of the project. As noted in the *Cumulative Effects* section of this Opinion, we have not identified any cumulative effects different than those considered in the *Status of the Species* and *Environmental Baseline* sections of this Opinion, inclusive of how those activities may contribute to climate change. As described in Section 7.10, climate change may result in changes in the distribution or abundance of Kemp's ridley sea turtles in the action area over the life of this project; however, we have not identified any different or exacerbated effects of the action in the context of anticipated climate change.

The impacts to Kemp's ridley sea turtles from the proposed action are expected to result in the harassment (inclusive of TTS and behavioral disturbance) of 2 individuals due to exposure to pile driving noise. No Kemp's ridley sea turtles are expected to be exposed to potentially disturbing levels of noise during UXO detonations. We also expect that 2 Kemp's ridley will be struck and killed by a project vessel over the 43 to 47-year life of the project inclusive of construction, operations, and decommissioning. We expect the capture of up to 1 Kemp's ridley sea turtles in the trawl surveys; we expect this individual will be released alive with only minor, recoverable injuries (minor scrapes and abrasions). We determined that all other effects of the action would be insignificant or extremely unlikely to occur. In total, we expect the proposed action to result in the mortality of two Kemp's ridley sea turtle over the 43 to 47-year life of the project.

The 2 Kemp's ridley sea turtles that experience harassment would experience behavioral disturbance and could suffer temporary hearing impairment (TTS); we also expect these turtles would experience physiological stress during the period that their normal behavioral patterns are disrupted (i.e., a period of several days). Aversion/avoidance behavior would be limited to the short period of time the animal is exposed to pile driving noise; TTS and associated disruptions to normal behavioral patterns (migrating, resting, feeding) will persist for a few days but are not expected to be experienced for more than a week. Any sea turtles affected by TTS would experience a temporary, recoverable, hearing loss manifested as a threshold shift around the frequency of the pile driving detonation noise (as relevant for the exposure). Sea turtles are not known to depend heavily on acoustic cues for vital biological functions (Nelms et al. 2016; Popper et al. 2014), and instead, may rely primarily on senses other than hearing for interacting with their environment, such as vision and magnetic orientation (Avens and Lohmann 2003; Putman et al. 2015). Because sea turtles do not vocalize or use noise to communicate, any TTS would not impact communications. However, to the extent that sea turtles do rely on acoustic cues from their environment, we expect that this temporary hearing impairment would affect frequencies utilized by sea turtles for acoustic cues such as the sound of waves, coastline noise, or the presence of a vessel or predator (Narazaki et al. 2013). If such cues increase survivorship (e.g., aid in avoiding predators, navigation), temporary loss of hearing sensitivity may have effects on the ability of a sea turtle to avoid threats which could decrease its ability to avoid those threats; this would be a significant disruption of behavioral patterns that creates the likelihood of injury. TTS of sea turtles is expected to only last for several days following the initial exposure (Moein et al. 1994). Given this short period of time, and that sea turtles are not known to rely heavily on acoustic cues, while TTS may impact the ability of affected individuals to avoid threats during the few days that TTS is experienced, we do not anticipate single TTSs would have any long-term impacts on the health or reproductive capacity or success of individual sea turtles.

The energetic consequences of avoidance/aversion behavior and any associated delay in resting or foraging will be disruptive for the period of time that the individual is exposed to the noise source. Similar effects are likely to be experienced in the period before the animal recovers from TSS. However, the limited duration means that these consequences are not expected to affect any individual's ability to successfully obtain enough food to maintain their health, or impact the ability of any individual to make seasonal migrations or participate in breeding or nesting. As a result of the energetic costs, evasive behaviors, and temporary impact on the ability to detect environmental cues which could affect the ability to avoid threats, TTS and behavioral disruption will create or increase the risk of injury for the affected sea turtles compared to those that are not exposed to these noise sources. However, as established herein, the temporary and limited nature of these effects means that it is unlikely that the behavioral disruption and temporary loss of hearing sensitivity would affect an individual sea turtle's fitness (i.e., survival or reproduction). As explained in Section 7.2 of this Opinion, we determined that effects to these 2 Kemp's ridley sea turtles meet NMFS interim definition of harassment but not the definition of harm.

The mortality of two Kemp's ridley over a 3943 to 47 year time period represents a very small percentage of the Kemp's ridleys worldwide. Even taking into account just nesting females (7-8,000), the death of two Kemp's ridleys represents less than 0.03% of the nesting female population. While the death of 2 Kemp's ridley will reduce the number of Kemp's ridleys compared to the number that would have been present absent the proposed actions, it is not likely that this reduction in numbers will change the status of this species or its stable to increasing trend as this loss represents a very small percentage of the population. Reproductive potential of Kemp's ridleys is not expected to be affected in any other way other than through a reduction in numbers of individuals.

A reduction in the number of Kemp's ridleys would have the effect of reducing the amount of potential reproduction, as any dead Kemp's ridleys would have no potential for future reproduction. In 2006, the most recent year for which data is available, there were an estimated 7-8,000 nesting females. While the species is thought to be female biased, there are likely to be several thousand adult males as well. Given the number of nesting adults, it is unlikely that the loss of 2 Kemp's ridley over 43 to 47 years would affect the success of nesting in any year. Additionally, this small reduction in potential nesters is expected to result in a small reduction in the number of eggs laid or hatchlings produced in future years and similarly, a very small effect on the strength of subsequent year classes. Even considering the potential future nesters that would be produced by the individual that would be killed as a result of the proposed action, any effect to future year classes is anticipated to be very small and would not change the stable to increasing trend of this species. Additionally, the proposed action will not affect nesting beaches in any way or disrupt migratory movements in a way that hinders access to nesting beaches or otherwise delays nesting.

The proposed action is not likely to reduce distribution because the action will not impede Kemp's ridleys from accessing foraging grounds or cause more than a temporary disruption to other migratory behaviors. Additionally, given the small percentage of the species that will be killed as a result of the proposed action, there is not likely to be any loss of unique genetic haplotypes and no loss of genetic diversity.

While generally speaking, the loss of a small number of individuals from a subpopulation or species may have an appreciable reduction on the numbers, reproduction and distribution of the species this is likely to occur only when there are very few individuals in a population, the individuals occur in a very limited geographic range or the species has extremely low levels of genetic diversity. This situation is not likely in the case of Kemp's ridleys because: the species is widely geographically distributed, it is not known to have low levels of genetic diversity, there are several thousand individuals in the population and the number of Kemp's ridleys is likely to be increasing and at worst is stable.

Based on the information provided above, the death of one Kemp's ridley sea turtles over 39 years will not appreciably reduce the likelihood of survival (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment). The proposed action will not affect Kemp's ridleys in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring and it will not result in effects to the environment which would prevent Kemp's ridleys from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) the species' nesting trend is increasing; (2) the death of 2 Kemp's ridley represents an extremely small percentage of the species as a whole; (3) the death of 2 Kemp's ridley will not change the status or trends of the species as a whole; (4) the loss of these Kemp's ridley is not likely to have an effect on the levels of genetic heterogeneity in the population; (5) the loss of these Kemp's ridley is likely to have such a small effect on reproductive output that the loss of this individual will not change the status or trends of the species; (5) the actions will have only a minor and temporary effect on the distribution of Kemp's ridleys in the action area and no effect on the distribution of the species throughout its range; and, (6) the actions will have no effect on the ability of Kemp's ridleys to shelter and only an insignificant effect on individual foraging Kemp's ridleys.

In rare instances, an action may not appreciably reduce the likelihood of a species survival (persistence) but may affect its likelihood of recovery or the rate at which recovery is expected to occur. As explained above, we have determined that the proposed action will not appreciably reduce the likelihood that Kemp's ridley sea turtles will survive in the wild. Here, we consider the potential for the actions to reduce the likelihood of recovery. As noted above, recovery is defined as the improvement in status such that listing is no longer appropriate. Thus, we have considered whether the proposed action will affect the likelihood that Kemp's ridleys can rebuild to a point where listing is no longer appropriate. In 2011, NMFS and the USFWS issued a recovery plan for Kemp's ridleys (NMFS et al. 2011). The plan includes a list of criteria necessary for recovery. These include:

1. An increase in the population size, specifically in relation to nesting females[62];

[62]A population of at least 10,000 nesting females in a season (as measured by clutch frequency per female per season) distributed at the primary nesting beaches in Mexico (Rancho Nuevo, Tepehuajes, and Playa Dos) is

2. An increase in the recruitment of hatchlings[63];
3. An increase in the number of nests at the nesting beaches;
4. Preservation and maintenance of nesting beaches (i.e. Rancho Nuevo, Tepehuajes, and Playa Dos); and,
5. Maintenance of sufficient foraging, migratory, and inter-nesting habitat.

Kemp's ridleys have an increasing trend; as explained above, the loss of two Kemp's ridley over the 43 to 47-year life of the project will not affect the population trend. The number of Kemp's ridleys likely to die as a result of the proposed actions is an extremely small percentage of the species. This loss will not affect the likelihood that the population will reach the size necessary for recovery or the rate at which recovery will occur. As such, the proposed action will not affect the likelihood that criteria one, two, or three will be achieved or the timeline on which they will be achieved. The action area does not include nesting beaches; therefore, the proposed actions will have no effect on the likelihood that recovery criteria four will be met. All effects to habitat will be insignificant or extremely unlikely to occur; therefore, the proposed actions will have no effect on the likelihood that criteria five will be met.

The effects of the proposed action will not hasten the extinction timeline or otherwise increase the danger of extinction. Further, the actions will not prevent the species from growing in a way that leads to recovery and the actions will not change the rate at which recovery can occur. This is the case because while the actions may result in a small reduction in the number of Kemp's ridleys and a small reduction in the amount of potential reproduction, these effects will be undetectable over the long-term and the actions are not expected to have long term impacts on the future growth of the population or its potential for recovery. Therefore, based on the analysis presented above, the proposed action will not appreciably reduce the likelihood that Kemp's ridley sea turtles can be brought to the point at which they are no longer listed as endangered or threatened; that is, the proposed action will not appreciably reduce the likelihood of recovery of Kemp's ridley sea turtles.

Despite the threats faced by individual Kemp's ridley sea turtles inside and outside of the action area, the proposed action will not increase the vulnerability of individual sea turtles to these additional threats and exposure to ongoing threats will not increase susceptibility to effects related to the proposed actions. We have considered the effects of the proposed action in light of the status of the species, Environmental Baseline and cumulative effects explained above, including climate change, and have concluded that even in light of the ongoing impacts of these activities and conditions; the conclusions reached above do not change.

Based on the analysis presented herein, the effects of the proposed action, resulting in the mortality of two Kemp's ridleys, are not likely to appreciably reduce the likelihood of both the

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attained in order for downlisting to occur; an average of 40,000 nesting females per season over a 6-year period by 2024 for delisting to occur

[63] Recruitment of at least 300,000 hatchlings to the marine environment per season at the three primary nesting beaches in Mexico (Rancho Nuevo, Tepehuajes, and Playa Dos).

survival and recovery of this species. These conclusions were made in consideration of the endangered status of Kemp's ridley sea turtles, effects of the action, other stressors that individuals are exposed to within the action area as described in the *Environmental Baseline* and *Cumulative Effects*, and any anticipated effects of climate change on the abundance and distribution of Kemp's ridleys in the action area.

10.0 CONCLUSION

After reviewing the current status of the ESA-listed species, the environmental baseline within the action area, the effects of the proposed action (50 CFR §402.02), including the consequences of other activities that are caused by the proposed action but that are not part of the action, and cumulative effects, it is our biological opinion that the proposed action is likely to adversely affect but is not likely to jeopardize the continued existence of blue, fin, sei, sperm, or North Atlantic right whales or the Northwest Atlantic DPS of loggerhead sea turtles, North Atlantic DPS of green sea turtles, Kemp's ridley or leatherback sea turtles, or any DPS of Atlantic sturgeon. We find that the proposed action is not likely to adversely affect shortnose sturgeon, hawksbill sea turtles, Rice's whales, or the Giant manta ray; thus, it is also not likely to jeopardize the continued existence of these species. We find that the proposed action will have no effect on the Gulf of Maine DPS of Atlantic salmon, Oceanic whitetip shark, Gulf sturgeon, Nassau grouper, smalltooth sawfish, any species of corals, or any designated critical habitat.

11.0 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulations promulgated pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species of fish or wildlife, respectively, without a permit or exemption. In the case of threatened species, section 4(d) of the ESA leaves it to the Secretary's discretion whether and to what extent to extend the statutory 9(a)(1) ''take'' prohibitions to such species. For the threatened species addressed here (Northwest Atlantic DPS of loggerhead sea turtles, North Atlantic DPS of green sea turtles, Gulf of Maine DPS of Atlantic sturgeon), regulations have been issued under section 4(d) of the ESA to extend the section 9 "take" prohibitions.

"Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm, as explained above, is further defined by regulation to include significant habitat modification or degradation that results in death or injury to ESA listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. NMFS, as we have explained, has not yet defined "harass" under the ESA in regulation, but has issued interim guidance on the term "harass," defining it as to "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering" (NMFS PD 02-110-19). We considered and applied the foregoing NMFS' interim definition of harassment in evaluating whether the proposed activities are likely to result in harassment of ESA listed species. Application of the definitions of ESA harm and harass was done independently of any consideration of whether the effect had or had not been identified as Level

A harassment or Level B harassment under the MMPA in the MMPA proposed incidental take regulations. Incidental take statements serve a number of functions, including providing reinitiation triggers for all anticipated take, identifying reasonable and prudent measures with implementing terms and conditions that will minimize the impact of anticipated incidental take and monitor incidental take that occurs, and providing exemption from the Section 9 prohibitions against take for endangered species and from any prohibition on take extended to threatened species by ESA Section 4(d) protective regulations for activities conducted in accordance with reasonable and prudent measures and implementing terms and conditions.

In those cases where the Service concludes that an action and the resultant incidental take of listed species will not violate section 7(a)(2), and, in the case of marine mammals, where the taking is authorized pursuant to section 101(a)(5) of the Marine Mammal Protection Act of 1972, NMFS must provide, with the biological opinion, an ITS that, among other things, specifies those measures that are necessary to comply with Section 101(a)(5) of the MMPA. Section 7(b)(4), section 7(o)(2), and ESA regulations provide that taking that is incidental to an otherwise lawful activity conducted by an action agency or applicant is not considered to be prohibited taking under the ESA if that activity is performed in compliance with the terms and conditions of this ITS, including those specified as necessary to comply with the MMPA, Section 101(a)(5). Accordingly, the terms of this ITS and the exemption from Section 9(a)(1) of the ESA, and any 4(d) rule extending the Section 9(a)(1) prohibition on take to threatened species, become effective only upon the issuance of a final MMPA authorization to take the ESA-listed marine mammals identified here and the incorporation of its mitigation measures in this ITS to the extent those measures are necessary to comply with section 101(a)(5) of the Marine Mammal Protection Act of 1972 and applicable regulations with regard to such taking. Absent a required authorization and incorporation of its mitigation measures, this ITS's exemption from the ESA Section 9 take prohibition as extended to threatened species through Section 4(d) regulations is inoperative for ESA listed marine mammals. As described in this Opinion, SouthCoast Wind, LLC has applied for an MMPA ITA; a decision regarding issuance of the ITA is expected in 2025 following issuance of the Record of Decision for the project. Once a final authorization is issued, we will review this ITS to ensure it includes all measures necessary to comply with the authorization, and if necessary, make appropriate modifications.

This ITS for sea turtles and Atlantic sturgeon is effective upon issuance, and the action agencies and applicant may receive the benefit of the sea turtle and sturgeon take exemption as long as they are complying with the applicable terms and conditions. This ITS for ESA listed marine mammals is not effective unless and until: (i) a final MMPA ITA that is required for some or all of the take of ESA-listed marine mammals identified here is effective and (ii) after review, NMFS determines the RPMs and terms and conditions in this ITS are consistent with the final mitigation measures in the ITA, and, if appropriate, makes necessary conforming modifications, as explained above.

The measures described below must be undertaken by the action agencies so that they become binding conditions for the exemption in section 7(o)(2) to apply. BOEM and other action agencies have a continuing duty to regulate the activity covered by this ITS. If one or more of them: (1) fails to assume and implement the terms and conditions, or (2) fails to require the project sponsor or their contractors to adhere to the terms and conditions of the ITS through enforceable terms and conditions that are included in any COP approval, grants, permits and/or contracts, the protective coverage of section 7(o)(2) may lapse. The protective coverage of section 7(o)(2) also may lapse if the project sponsor fails to comply with the terms and conditions and the minimization and mitigation measures included in the ITS as well as those described in the proposed action and set forth in Section 3 of this opinion as we consider those measures necessary and appropriate to minimize take but have not restated them here for efficiency. In order to monitor the impact of incidental take, BOEM, other action agencies, and SouthCoast must report the progress of the action and its impact on the species to us as specified in the ITS [50 CFR §402.14(i)(3)] (See U.S. Fish and Wildlife Service and National Marine Fisheries Service's Joint Endangered Species Act Section 7 Consultation Handbook (1998) at 4-49).

11.1 Amount or Extent of Take

Section 7 regulations require NMFS to specify the impact of any incidental take of endangered or threatened species; that is, the amount or extent of such incidental taking on the species (50 C.F.R. §402.14(i)(1)(i)). The amount and extent of take we have determined is reasonably certain to occur is identified below. No other incidental take is anticipated. We anticipate no more than the amount and type of take described below to result from the construction, operation, and decommissioning of the SouthCoast project as proposed for approval by BOEM and pursuant to other permits, authorizations, and approvals by BSEE, USACE, and NMFS OPR. There is no incidental take anticipated to result from EPA's proposed issuance of an Outer Continental Shelf Air Permit or NPDES permit or the USCG's proposed issuance of a Private Aids to Navigation (PATON) authorization.

Vessel Strike

We calculated the number of sea turtles likely to be struck by project vessels based on the anticipated increase in vessel traffic during the construction, operations, and decommissioning phases of the project. The following amount of incidental take is exempted over the life of the project, inclusive of construction, operations, and decommissioning.

Species/DPS	Vessel Strike Mortality
Kemp's ridley sea turtle	2
Leatherback sea turtle	19
North Atlantic DPS green sea turtle	2
Northwest Atlantic DPS Loggerhead sea turtle	19

No take of any species of ESA listed whales or any DPS of Atlantic sturgeon by vessel strike is anticipated or exempted.

Surveys of Fisheries Resources

We calculated the number of sea turtles and Atlantic sturgeon likely to be captured in trawl gear over the period that the surveys are planned based on available information on capture and injury/mortality rates in similar surveys. The following amount of incidental take is exempted over the duration of the planned trawl survey (five survey years):

Species/DPS	Trawl Surveys	
	Capture, Minor Injury	Serious Injury/Mortality
Gulf of Maine DPS Atlantic sturgeon	1*	None
New York Bight DPS Atlantic sturgeon	3	None
Chesapeake Bay DPS Atlantic sturgeon	1	None
South Atlantic DPS Atlantic sturgeon	1*	None
Carolina DPS Atlantic sturgeon	1*	None
Kemp's ridley sea turtle	2**	None
Leatherback sea turtle	None	None
North Atlantic DPS green sea turtle	2**	None
Northwest Atlantic DPS Loggerhead sea turtle	2**	None

*1 Atlantic sturgeon from the South Atlantic or Carolina or Gulf of Maine DPS
**2 hard shelled sea turtles total – combination of Kemp's ridley, green, and/or loggerhead

No take of any species of ESA listed whale is anticipated or exempted for the proposed surveys. If any additional surveys are planned or the survey duration is extended, consultation may need to be reinitiated.

Foundation Installation (Vibratory and Impact Pile Driving)
We calculated the number of whales and sea turtles expected to be harmed (Permanent Threshold Shift/acoustic injury) or harassed (Temporary Threshold Shift and/or Behavioral Disturbance) due to exposure to pile driving noise during foundation installation based on the proposed construction scenario (i.e., 149 total foundations, meeting the isopleth distances identified for 10 dB attenuation).

Species/DPS	Take due to Exposure to Noise during Foundation Installation (Project 1 and 2 Combined)	
	Harm/Injury (PTS)	Harassment (TTS/ Behavior)
Blue whale	None	2
Fin whale	7	520
North Atlantic right whale	None	109
Sei Whale	None	47
Sperm whale	None	135
North Atlantic DPS green sea turtle	None	2
Kemp's ridley sea turtle	None	2
Leatherback sea turtle	5	13
Northwest Atlantic DPS Loggerhead sea turtle	2	9
Atlantic sturgeon – all five DPSs	None	None

UXO/MEC Detonation

We calculated the number of whales and sea turtles likely to be harmed (PTS/acoustic injury) or harassed (TTS and/or behavioral disturbance) due to exposure to UXO detonation based on the maximum impact scenario (i.e., 10 detonations, meeting the isopleth distances identified for 10 dB attenuation). The numbers below are the amount of take anticipated in consideration of 10 UXO detonations total.

Species	UXO Detonation	
	Harm/Injury (PTS)	Harassment (TTS)
Blue whale	None	2
Fin whale	None	49
North Atlantic right whale	None	28
Sei Whale	None	16
Sperm whale	None	4
Kemp's ridley sea turtle	None	None
Leatherback sea turtle	None	1
North Atlantic DPS green sea turtle	None	None
Northwest Atlantic DPS Loggerhead sea turtle	None	None
Atlantic sturgeon – all 5 DPSs	None	None

Hydrodynamic Wakes from Project Foundations
As described in section 7.4 of this Opinion, we calculated the number of North Atlantic right whales likely to experience harassment as a result of effects from hydrodynamic wakes from project foundations. No take of any other ESA listed species is anticipated or exempted. The following amount of incidental take is exempted over the duration of the proposed action, based on a 44-year period when project foundations are present in the lease area:

Species	Harassment
North Atlantic right whales	44

We considered several methods to monitor the amount of take (i.e., harassment of up to 44 right whales over the life of the project). We considered requiring monitoring the movements and behavior of individual right whales within the lease area; however, we expect that the monitoring that would be required to track take of individuals (i.e., to establish if a given right whale had experienced effects that create the likelihood of injury by annoying it to such an extent as to to significantly disrupt normal behavioral patterns (in this case, foraging) would require sustained tagging and tracking of compromised individuals. This intense and potentially invasive monitoring of individuals that are already entangled, in poor health, or otherwise in a more vulnerable state, would likely cause further adverse effects. Further, we have not identified any accepted monitoring techniques that could be implemented that would not carry such risks. While we recognize that future technology may support such a monitoring approach, we do not find it feasible at this time. Because we have not identified a method to monitor individual right whales that would be reasonable and prudent and necessary or appropriate, we will use a means other than counting/tracking individuals to monitor the estimated numerical level of take and provide a means for reinitiating consultation once that level has been exceeded.

Monitoring and counting individuals is further complicated by the variability in the number of right whales that exist in a given year as well as factors that may affect the number of individuals that forage in the lease area in a given year. We have identified a percentage of the right whale population that we expect will experience effects attributable to the presence of the project foundations (i.e. disturbance) that will affect foraging behavior in a manner that we determined is consistent with NMFS interim definition of harassment (i.e. significantly disrupt normal behavioral pattern). We have applied that percentage to the best available population estimate for right whales and thereby have identified the amount of incidental take. However, given that the size of the right whale population fluctuates and that the species trajectory is uncertain, the number of individual right whales that will be taken by harassment is expected to be variable annually. For example, if the population increases over time, more individuals could be taken by harassment even if the percentage of the population affected stays the same. We explain in the Integration and Synthesis section of this Opinion why we find that the proposed action is not likely to jeopardize the continued existence of the species even considering how the population size, and thereby the number of affected individuals, may fluctuate over the life of the SouthCoast project.

Because all of the monitoring methods considered above are neither reasonable and prudent nor necessary or appropriate, we will use a means other than counting individuals to monitor the estimated numerical level of take and provide a measurable trigger for reinitiating consultation once that level has been exceeded. As established in section 7.4 of this Opinion, take (harassment) of some right whales is expected to occur as a result of hydrodynamic wake effects caused by the presence of foundations which will result in near-field disruptions in the distribution and aggregation of zooplankton prey. We explain how we expect these disruptions to occur in an area that extends an average of up to 1,000 m around each of the up to 149 foundations that will be installed to support WTGs and the OSPs and that no wakes will be large enough to interact with wakes from adjacent foundations (considering the 1,800 m spacing between foundations). These disruptions in habitat will significantly disrupt normal patterns of foraging behavior that, for some already compromised individuals, would create the likelihood of injury. Therefore, for this action, the spatial and temporal extent of the area around each foundation where hydrodynamic wake effects are experienced provides a reasonable, science-based metric for monitoring the actual amount of incidental take that we anticipate. We expect that this will be the primary method of determining whether incidental take has been exceeded. The identified metric (extent of hydrodynamic wake effects around each foundation) can be effectively monitored and annual monitoring reports will provide a means for determining when the level of anticipated take has been exceeded. Our estimate of take (harassment) is based on the application of the best available scientific information, which predicts hydrodynamic wake effects will extend, on average, up to 1,000 m from any given foundation and would not extend beyond 1,800 m.

<u>We will consider that the amount of incidental take has been exceeded if monitoring, carried out consistent with an approved monitoring plan, demonstrates that in a given year (considering seasonal and other variation), the extent of hydrodynamic wakes exceeds 1,800 m at any foundation and exceeds an average of 1,000 m across all foundations monitored.</u> We consider that this would indicate that the geographic extent of the area where foraging would be disrupted is bigger than we anticipated, which indicates that either a greater number of right whales would experience effects that met the interim definition of harassment or that the extent of the disruptions were greater than anticipated.

The disturbance causing take, as noted, will be caused by the presence of fixed structures in the water. We have not identified any reasonable and prudent measures or implementing terms and conditions that would minimize the amount or extent of this incidental take: as we note below, this is primarily due to the inability to affect operational changes to fixed structures that could minimize prey disturbance. Reasonable and prudent measures and the terms and conditions that implement them cannot alter the basic design, location, scope, duration, or timing of the action and may involve only minor changes (50 CFR§ 402. 14(i)(2)). As explained in section 7.4, we expect that these disruptions would occur from either monopile or jacket foundations. While it is possible that the geographic extent of the disruption around each foundation would be less for jacket foundations (in consideration of the smaller diameter of the pin piles compared to the planned monopiles), any given jacket foundation has four piles compared to one, thus it is not certain that there would be any meaningful reduction in the amount or extent of take if the projects were installed with any given percentage of pin pile foundations. We have also considered whether removal of turbine foundations from either Project 1 or Project 2 would minimize the amount or extent of take. It is likely that removal of turbine foundations from the positions closest to Nantucket Shoals would reduce the extent of overlap between foraging right whales and hydrodynamic wakes; however, we consider that such a potential RPM would not be reasonable, because it would significantly alter the design and scope (by reducing electrical generating capacity) of the project and therefore would likely violate the minor change rule. We also note that because the effects are anticipated as a result of the presence of the fixed foundations and not the operation of the WTGs, measures that would alter the timing or duration of WTG operation (e.g., limiting operation at times of year when NARWs are present) would not be expected to minimize take.

Additionally, we have not identified any “offsetting” RPMs; that is, we have not identified any available and effective RPMs inside or outside of the action area that avoid, reduce, or offset the impact of incidental take. As explained in section 7.4 of this Opinion, while all right whales in the lease area will be exposed to the hydrodynamic wakes and resulting effects to zooplankton, we only expect that the effects of disruptions of foraging behavior would result in harassment of right whales that are already compromised (i.e., poor body condition, entangled, already injured, or in an otherwise particularly vulnerable condition). We recognize that the higher the proportion of the population is of healthy, non-entangled, uninjured animals, the lower the number of individuals that experience harassment will be. As such, we can generally identify that improvements in the condition of right whales within and outside the action area would avoid or reduce the amount of take and similarly, if there was a way to increase zooplankton quantity or quality in other areas this may offset the effects of the anticipated foraging disruptions. However, we have not identified any measures that the action agencies or SouthCoast could implement that would be consistent with the requirements for RPMs and implementing Terms and Conditions. The RPM and implementing Term and Condition below is designed to monitor the effects of the action and provide a means for determining if take has been exceeded.

11.2 Effects of the Take

In this opinion, we determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to jeopardize the continued existence of any ESA listed species under NMFS’ jurisdiction.

11.3 Reasonable and Prudent Measures and Terms and Conditions

Section 7(b)(4) of the ESA requires that when a proposed agency action is found to be consistent with section 7(a)(2) of the ESA and the proposed action is likely to incidentally take individuals of ESA-listed species, NMFS will issue a statement that specifies the impact of any incidental taking of endangered or threatened species. To minimize such impacts, reasonable and prudent measures, and terms and conditions to implement the measures, must be provided. Only incidental take specified in this ITS that would not occur but for the agency actions described in the Opinion, and any specified reasonable and prudent measures and terms and conditions identified in the ITS, are exempt from the taking prohibition of section 9(a) for endangered species, as extended to threatened species through Section 4(d) regulations, provided that, pursuant to section 7(o) of the ESA, such taking is in compliance with the terms of the ITS.

Reasonable and prudent measures (RPMs) are measures to minimize the impact (i.e., amount or extent) of incidental take (50 C.F.R. §402.02). The RPMs determined to be necessary and appropriate and implementing terms and conditions are specified as required by 50 CFR 402.14 (i)(1) to minimize the impact of incidental take of ESA-listed species by the proposed action, to document and report that incidental take, and to specify the procedures to be used to handle or dispose of any individuals of a species actually taken. In order for the take exemption to be effective, the RPMs and their terms and conditions are nondiscretionary for the action agencies and applicant. In addition to the minimization measures specified in Section 3 (inclusive of the cited appendixes), which, as noted, we consider necessary and appropriate but do not repeat for the sake of efficiency, the RPMs and terms and conditions must be undertaken by the appropriate Federal agency so that they become binding conditions of any COP approval, permit, other authorization, or approval for the exemption in section 7(o)(2) to apply.

NMFS has determined that the RPMs identified here are necessary and appropriate to minimize impacts of incidental take that might otherwise result from the proposed action, to monitor document and report incidental take that does occur, and to specify the procedures to be used to handle or dispose of any individual listed species taken. These RPMs and their implementing terms and conditions are in addition to the measures that SouthCoast has included in its COP, the additional measures that BOEM has proposed to be required as conditions of COP approval, and the mitigation measures identified in the proposed ITA issued by NMFS as all these are considered part of the proposed action (see Section 3 above). All of the conditions identified in Section 3 of this Opinion, including those included in Appendix A, B, and C, are considered part of the proposed action and not repeated here, yet must be complied with for the conclusions of this Opinion and for the take exemption to apply. For example, the prohibition on impact pile driving from January 1 – May 15 throughout the lease area is considered part of the proposed action, and it is not repeated here as an RPM or term and condition; yet it is critical to minimizing take of North Atlantic right whale. In some cases, the RPMs and Terms and Conditions provide additional detail or clarity to measures that are part of the proposed action (e.g., the SFV requirements). A failure to implement the measures identified as part of the proposed action in Section 3 of this Opinion would be a change in the action that may necessitate reinitiation of consultation and may render the conclusions of this Opinion and the take exemption inapplicable to the activities that are carried out, and may necessitate reinitiation of consultation.

We have determined that all of the RPMs and Terms and Conditions are reasonable and prudent and necessary and appropriate to minimize or document and report the level of incidental take associated with the proposed action. None of the RPMs or the terms and conditions that implement them alter the basic design, location, scope, duration, or timing of the action and all of them involve only minor changes (50 CFR§ 402.14(i)(2)). A copy of this ITS must be on board all survey vessels and PSO platforms.

Reasonable and Prudent Measures

We have determined the following RPMs are necessary and appropriate to minimize, monitor, document, and report the impacts of incidental take of threatened and endangered species that occurs during implementation of the proposed action:

1. Effects to ESA listed species must be minimized and monitored during WTG and OSP foundation installation.
2. Effects to ESA listed species must be minimized and monitored during UXO/MEC detonations.
3. Effects to North Atlantic right whales from hydrodynamic effects (wakes) around foundations must be monitored.
4. Effects to, or interactions with, ESA listed species must be properly documented during all phases of the proposed action, and all incidental take must be reported to NMFS GARFO.
5. Plans must be prepared that describe the implementation of activities and/or monitoring protocols for which the details were not available at the time this consultation was completed. All required plans must be submitted to NMFS GARFO in advance of the applicable activity with sufficient time for review, comment, and any required concurrence.
6. BOEM, BSEE, NMFS OPR, and USACE must exercise their authorities to assess and ensure compliance with the implementation of measures to avoid, minimize, monitor, and report incidental take of ESA listed species during activities described in this Opinion. On-site observation and inspection by appropriate agency personnel must be allowed to gather information on the implementation of measures, and the effectiveness of those measures, to minimize and monitor incidental take during activities described in this Opinion, including its Incidental Take Statement.

Terms and Conditions
To be exempt from the prohibitions of Section 9 of the ESA for endangered species, as extended to threatened species through Section 4(d) regulations, the federal action agencies (BOEM, BSEE, USACE, and NMFS OPR, each consistent with their own legal authority) and SouthCoast (the lessee and applicant), must comply with the following terms and conditions (T&C), which implement the RPMs above. These include the take minimization, monitoring, and reporting measures required by the Section 7 regulations (50 C.F.R. §402.14(i)). These terms and conditions are non-discretionary; that is, if the Federal action agencies and/or SouthCoast fail to ensure compliance with these terms and conditions and the RPMs they implement, the protective coverage of Section 7(o)(2) may lapse. Note that throughout these Terms and Conditions we have identified a number of places where we direct reporting to BOEM, BSEE, USACE, and/or NMFS OPR in addition to NMFS GARFO. These additions have been made at the request of the action agencies; reporting to the action agencies in addition to NMFS GARFO aids in monitoring incidental take and monitoring implementation of these measures. All plans or reports must be submitted by email to nmfs.gar.incidental-take@noaa.gov unless otherwise indicated below.

1. To implement the requirements of RPM 1 and 2, for ESA listed whales, SouthCoast must comply with the measures specified in the proposed MMPA ITA (which are incorporated into the proposed action) as modified or supplemented in the final MMPA ITA, to minimize effects of foundation installation, UXO detonations, and other activities on ESA listed whales. To facilitate implementation of this requirement:
    a. BOEM must require, through an enforceable condition of their approval of SouthCoast's Construction and Operations Plan, SouthCoast to comply with any measures for ESA-listed species included in the proposed ITA, which already

have been incorporated into the proposed action, as modified or supplemented by the final MMPA ITA.

b. NMFS OPR must ensure SouthCoast's compliance with all mitigation measures as prescribed in the final ITA. We expect this will be carried out through NMFS OPR's review of plans and monitoring reports, including interim and final SFV reports, submitted by SouthCoast over the life of the MMPA ITA and taking any responsive action within its statutory and regulatory authority it deems necessary to ensure compliance with all final ITA mitigation measures based on the foregoing review.

c. The USACE must require, through an enforceable conditions of their individual permit authorization, that SouthCoast comply with any measures in the proposed MMPA ITA regarding ESA-listed marine mammals, which have already been incorporated into the proposed action, and as modified or supplemented by the final MMPA ITA.

2. To implement the requirements of RPM 1, the following measures related to sound field verification (SFV) for pile driving (impact and vibratory) carried out for WTG and OSP foundation installation must be required by BOEM, BSEE, USACE, and implemented by SouthCoast. The purpose of SFV and the steps outlined here are to ensure that SouthCoast does not exceed the distances to the auditory injury (i.e., harm) or behavioral harassment threshold (Level A and Level B harassment respectively) for ESA listed marine mammals, the harm or behavioral harassment thresholds for sea turtles, or the harm or behavioral disturbance thresholds for Atlantic sturgeon as analyzed in the Opinion. These thresholds and the distances to them, identified and described in this Opinion, underpin the effects analysis, exposure analysis, and our determination of the amount and extent of incidental take anticipated and exempted in this ITS, including any determination that no incidental take is anticipated (e.g., for Atlantic sturgeon exposed to pile driving noise). The measures outlined here are based on the expectation that the initial pile driving methodology (inclusive of impact pile driving and vibratory pile setting) and sound attenuation measures will result in noise levels that do not exceed the identified distances (as modeled assuming 10 dB attenuation; see Tables 7.1.9-7.1.14, 7.1.33-7.1.35, and 7.1.44)[64] but, if that is not the case, provide a step-wise approach for modifying operations and/or modifying or adding noise attenuation measures that can reasonably be expected to avoid exceeding those thresholds for the next pile being driven. These requirements are only in place for pile driven foundations (i.e., they do not apply to suction bucket foundations).

a. BOEM, BSEE, and USACE must require, and SouthCoast must implement a *Sound Field Verification Plan*, addressing Thorough and Abbreviated SFV, consistent with the requirements in T&C 13.d below. <u>Thorough SFV</u> consists of: SFV measurements made at a minimum of four distances from the pile(s) being driven, along a single transect, in the direction of lowest transmission loss (i.e.,

[64] As noted in section 7.1 of the Opinion, when these tables reference exposure ranges, SFV results will be compared to the appropriate corresponding distances calculated for acoustic ranges as reported in Limpert et al. 2024, LGL 2024 (October 2024, Updated Marine Mammal Take Estimates and Shutdown Zones for Construction of the SouthCoast Wind Project) or any updates to those reports.

projected lowest transmission loss coefficient), including, but not limited to, 750 m and three additional ranges selected such that measurement of identified isopleths are accurate, feasible, and avoid extrapolation. At least one additional measurement at an azimuth 90 degrees from the array at approximately 750 m must be made. At each measurement location, there must be a near-bottom and mid-water column hydrophone (measurement systems); the recordings must be continuous starting 30 minutes before pile driving and continuing throughout the duration of all pile driving and for at least 30 minutes after pile driving for that foundation is complete. Abbreviated SFV consists of: SFV measurements made at a single acoustic recorder, consisting of a near-bottom and mid-water hydrophone, at approximately 750 m from the pile, in the direction of lowest transmission loss, with continuous recordings starting 30 minutes before pile driving and continuing throughout the duration of all pile driving and for at least 30 minutes after pile driving for that foundation is complete.

b. BOEM, BSEE, and USACE must require, and SouthCoast must implement Thorough SFV, as detailed herein, for at least the following foundations:

    i. Project 1 (impact pile driving only): the first 3 monopiles installed; the first WTG jacket foundation (all piles) installed; the first WTG monopile and first WTG jacket foundation (all four pin piles) installed in December (winter sound speed profile); all OSP jacket foundation pin piles; and, the first foundation for any foundation scenarios that were modeled for the exposure analysis (e.g., expected hammer energy, number of strikes, representative location) that does not fall into one of the previously listed categories and for any larger piles or if additional monopiles or pin piles supporting jacket foundations are driven that may produce louder sound fields than those previously measured (e.g., from higher hammer energy, greater number of strikes).

        - In the event that Project 1 foundation installation continues into a second construction season: if there are no changes to the pile driving equipment from year 1 (i.e., same hammer, same vessel spread, and same Noise Attenuation System) – the first monopile and first jacket foundation (all piles); if there are changes to the pile driving equipment from year 1 (i.e., hammer, vessel spread, and/or Noise Attenuation System) – the first three monopiles and first WTG jacket foundations (all four pin piles);

    ii. Project 2: the first 3 monopiles installed with a vibratory hammer followed by an impact hammer; the first monopile installed with impact hammer only; the first WTG jacket foundation (all four pin piles) installed with a vibratory hammer followed by an impact hammer; the first WTG jacket foundation (all four pin piles) installed with an impact hammer only; all OSP jacket foundation pin piles; the first monopile and first jacket foundation (all piles) installed in December (winter sound speed profile) with an impact hammer only and first monopile and first jacket foundation (all four pin piles) installed in December with a vibratory hammer followed by an impact hammer; and, the first foundation for any foundation scenarios that were modeled for the exposure analysis (e.g., expected hammer energy, number of strikes, representative location) that does not fall into one of the previously listed categories and for any larger piles or if additional monopiles or pin piles supporting jacket foundations are driven that may produce louder sound fields than those previously measured (e.g., from higher hammer energy, greater number of strikes).

iii. Any subsequent construction year (i.e., if Project 2 pile driving continues into a subsequent year):

- if there are no changes to the pile driving equipment from the previous year (i.e., same hammer, same vessel spread, same Noise Attenuation System) – the first monopile and first jacket foundation (all piles) installed with only an impact hammer and first monopile and first jacket foundation (all piles) installed with a vibratory hammer followed by an impact hammer;
- for any foundation type or technique included in the requirements for the first or second construction year that was not installed until a subsequent construction year, the requirements outlined for year 2 apply (e.g., if vibratory pile setting for a monopile is not used until year 3, the first three monopiles where vibratory pile setting is used must have Thorough SFV).

iv. These initial pile installations, which require Thorough SFV, must be carried out during daylight hours only, regardless of whether there is an approved *Nighttime Pile Driving Plan*.

c. During Thorough SFV, installation of the next foundation (of the same type/foundation method) may not proceed until SouthCoast has reviewed the initial results from the Thorough SFV and determined that there were no exceedances of any distances to the identified thresholds based on modeling assuming 10 dB attenuation (see Tables 7.1.9-7.1.14, 7.1.33-7.1.35, and 7.1.44). As noted below, Interim Thorough SFV monitoring reports must be submitted to NMFS GARFO (nmfs.gar.incidental-take@noaa.gov) within 48 hours of completion of the monitored pile; this report must include notification of any exceedances and planned next steps in compliance with 2.d. below.

d. If any of the Thorough SFV measurements from any pile indicate that the distance to any isopleth of concern for any species is greater than those modeled assuming 10 dB attenuation, SouthCoast must notify BOEM, BSEE, USACE, NMFS OPR, and NMFS GARFO (by email to nmfs.gar.incidental-take@noaa.gov) within 24 hours of reviewing the Thorough SFV measurements and must implement the following measures for the next pile of the same type/installation methodology, as applicable. These requirements are in place for WTG and OSP monopile and jacket foundations and repeat until the criteria in 2.d.ii.a or 2.d.ii.b are met.

i. Minimum Visibility, Clearance, and Shutdown Zones. Adjustments to minimum visibility, clearance, and shutdown zones for marine mammals must be made consistent with any requirements for modifying zone sizes identified in the final LOA. SouthCoast must deploy any additional PSOs consistent with the approved *Pile Driving Monitoring Plan* (T&C 12.a) in consideration of the size of the new zones and the species that must be monitored (i.e., sea turtles and/or whales); for every 1,500 m that a marine mammal clearance or shutdown zone is expanded, additional PSOs must be deployed from additional platforms/vessels to ensure adequate and complete monitoring of the expanded shutdown and/or clearance zone (with each PSO responsible for scanning no more than 120 degrees out to a radius no greater than 1,500 m. A description of the expanded minimum visibility, clearance, and/or shutdown zones and deployment of any additional PSOs must be included in the 48-hour report noted above. Use of the expanded clearance and shutdown zones must continue for all subsequent piles of the same type/installation scenario until SouthCoast requests and receives concurrence from NMFS GARFO and/or NMFS OPR to revert to the original clearance and shutdown zones.

ii. <u>Attenuation Measures.</u> SouthCoast must identify one or more additional, modified, and/or alternative noise attenuation measure(s) and/or operational change(s) included in the approved *SFV Plan* (see 12.d) that is expected to reduce sound levels to the modeled distances and must implement that measure for all subsequent piles of the same type and pile driving method that is installed (e.g., if triggered by SFV results for a monopile installed with vibratory pile driving followed by impact pile driving, for the next monopile with vibratory pile driving followed by impact pile driving). Attenuation measures/operational changes that could reduce sound levels to the modeled distances include but are not limited to adding a noise attenuation device, adjusting hammer operations, and adjusting or otherwise modifying the noise mitigation system. A description of the additional, modified, and/or alternative noise attenuation measure(s) and/or operational change(s) must be included in the 48-hour report noted above.

a. If no additional, modified, and/or alternative measures or operational changes are identified for implementation, or if Thorough SFV of a third pile of the same type and installation method (i.e., the pile installed with a second round of additional/modified noise attenuation or pile driving operations) indicates that the distance to any isopleths of concerns for any ESA listed species are still greater than those modeled assuming 10 dB attenuation, installation of that foundation type/installation methodology must be paused until there is concurrence from NMFS, BOEM, and BSEE to proceed. NMFS GARFO, NMFS OPR, BOEM, BSEE, and USACE will meet within three business days of installation of the pile that triggered condition 2.d.ii.a to discuss: the results of the Thorough SFV monitoring, the severity of exceedance of distances to identified isopleths of concern, the species affected, modeling assumptions, and whether any triggers for reinitiation of consultation are met (50 CFR 402.16), including consideration of whether the Thorough SFV results constitute new information revealing effects of the action that may affect listed species in a manner or to an extent not previously considered in the consultation. Implementation of additional measures to reduce noise and additional Thorough SFV may also be required as a result of this meeting.

b. Following installation of a pile with additional, alternative, or modified noise attenuation measures/operational changes required by 2.d if Thorough SFV results indicate that all isopleths of concern are within distances to isopleths of concern modeled assuming 10 dB attenuation, Thorough SFV must be conducted on two additional piles (three for pin piles) of the same type/installation method (for a total of at least three consecutive monopiles or four consecutive pin piles with consistent noise attenuation measures). If the Thorough SFV results from all three monopiles or all four pin piles are within the distances to isopleths of concern modeled assuming 10 dB attenuation, then BOEM, BSEE, and USACE must require, and SouthCoast must continue to implement the additional, alternative, or modified noise attenuation measures/operational changes for all subsequent piles of the same type/installation methodology and can move to Abbreviated SFV for the next pile of that type/installation method (see 2.e below). SouthCoast can request concurrence from NMFS GARFO and NMFS OPR to return to the original clearance and shutdown zones (if they had been adjusted) (Table 11.1).

e. BOEM, BSEE, and USACE must require, and SouthCoast must implement Abbreviated SFV for all piles for which the Thorough SFV monitoring outlined above is not carried out. The transition to Abbreviated SFV can be made once Thorough SFV results indicate that for three consecutive monopiles and four consecutive pin piles (installed with the same methodology) all isopleths of concern are within distances to isopleths of concern modeled assuming 10 dB attenuation. SouthCoast must submit notification of the transition to Abbreviated SFV to NMFS GARFO by email. The Abbreviated SFV data collected will be used to compare to the levels defined as a result of Thorough SFV to assess whether the representative levels at approximately 750 m were exceeded. Results of all Abbreviated SFV must be submitted with the weekly pile driving report.

   i. SouthCoast must review Abbreviated SFV results for each pile within 24 hours of completion of the foundation installation (inclusive of impact and vibratory pile driving). The only exceptions to this requirement for 24-

hour review are if weather conditions prevent safe retrieval of the hydrophones; in that case, the inability to retrieve the hydrophones must be reported to NMFS within 24 hours of making that determination. If measured levels at 750 m did not exceed the expected levels defined during Thorough SFV, SouthCoast does not need to take any additional action and can proceed to the next pile and conduct Abbreviated SFV.

ii. If measured levels from Abbreviated SFV for any pile are greater than expected levels (as defined by Thorough SFV, also referred to as "estimated received levels"), SouthCoast must evaluate the available information from the pile installation to identify and implement corrective action on the next pile of the same type/installation method that is installed, and report this information to BOEM, BSEE, USACE, and NMFS GARFO within 48 hours of completion of the installation of the pile during which the exceedance occurred. SouthCoast is required to remedy any failure of the noise attenuation system prior to carrying out any additional pile driving.

iii. If following corrective action to the noise attenuation system, or other adjustments, SouthCoast determines that results of Abbreviated SFV monitoring for a subsequent pile exceed expected values at 750 m, SouthCoast must notify NMFS within 24 hours of that determination. BOEM, BSEE, USACE, NMFS OPR, and NMFS GARFO will, to the maximum extent practicable, meet within two business days of that notification to discuss: the results of SFV monitoring, the severity of exceedance of distances to identified isopleths of concern, the species affected, modeling assumptions, whether any additional, modified, and/or alternative noise attenuation measure(s), and/or operational change(s) can be implemented, and whether any triggers for reinitiation of consultation are met (50 CFR 402.16), including consideration of whether the SFV results constitute new information revealing effects of the action that may affect listed species in a manner or to an extent not previously considered in the consultation. Additional measures and Thorough SFV may be required as a result of this meeting.

3. To implement the requirements of RPM 2, the following measures must be required by BOEM, BSEE, and/or USACE and implemented by SouthCoast:

   a. In addition to the establishment and maintenance of clearance zones for marine mammals described in section 3 (see Table 11.1), establish a clearance zone for sea turtles extending 500 m around any planned UXO/MEC detonations of all charge sizes. Maintain the clearance zone for at least 60 minutes prior to any UXO/MEC detonation. This requirement clarifies the size of the clearance zone for sea turtles. SouthCoast must ensure that there is sufficient PSO coverage to reliably document sea turtle presence within the clearance zone as described in the *Marine Mammal and Sea Turtle Monitoring Plan* (see T&C 12a). In the event that a PSO detects a sea turtle inside the 500 m clearance zone, detonation will be delayed until the sea turtle has not been observed for 30 minutes or has been observed to have left the clearance zone.

b. Provide BOEM, BSEE, and NMFS GARFO with notification of planned UXO/MEC detonation as soon as possible but at least 72 hours prior to the planned detonation, unless this 72-hour notification would create delays to the detonation that would result in imminent risk of human life or safety. This notification must include the coordinates of the planned detonation, the estimated charge size, and any other information available on the characteristics of the UXO/MEC. NMFS GARFO will provide alerts to NMFS sea turtle and marine mammal stranding network partners consistent with best practices. Notification must be provided via email to nmfs.gar.incidental-take@noaa.gov and by phone to the NMFS GARFO Protected Resources Division (978-281-9328) and BSEE via TIMSWeb.

c. The following measures related to SFV for UXO/MEC detonation must be required by BOEM, BSEE, and/or USACE and be implemented by SouthCoast. The purpose of SFV and the steps outlined here are to ensure that SouthCoast does not exceed the distances to the injury (i.e., harm) or harassment thresholds for ESA listed marine mammals, the PTS or TTS thresholds for sea turtles, or the onset of injury thresholds for Atlantic sturgeon that are identified in this Opinion and that underpin the effects analysis, exposure analysis and our determination of the amount and extent of incidental take exempted in this ITS, including the determination that no incidental take is anticipated in some cases. The measures outlined here are based on the expectation that SouthCoast's initial UXO/MEC detonation methodology and sound attenuation measures will result in noise levels that do not exceed the identified distances to thresholds (as modeled assuming 10 dB attenuation, see Tables 7.1.24-7.1.26, 7.1.40, 7.1.45) but, if that is not the case, provide a step-wise approach for modifying operations and/or modifying or adding sound attenuation measures that can reasonably be expected to avoid exceeding the distances to those thresholds prior to the next planned detonation.

- Consistent with requirements incorporated into the proposed action, SouthCoast must implement Thorough SFV on all UXO/MEC detonations (see also T&C 13.c below) in accordance with the requirements specified here. <u>Thorough SFV</u> consists of: SFV measurements made at a minimum of four distances from the UXO/MEC being detonated, along a single transect, in the direction of lowest transmission loss (i.e., projected lowest transmission loss coefficient), including, but not limited to, 750 m and three additional ranges selected such that measurement of identified isopleths are accurate, feasible, and avoid extrapolation. At least one additional measurement at an azimuth 90 degrees from the array at approximately 750 m must be made. At each measurement location, there must be a near-bottom and mid-water column hydrophone (measurement systems); the recordings must be continuous starting 30 minutes before the detonation and continuing throughout the duration of the detonation and for at least 30 minutes after the detonation is complete. SouthCoast must also deploy a pressure transducer. If any of the SFV measurements from any detonations indicate that the distance to any isopleth of concern is larger than those modeled assuming 10 dB attenuation (see Tables 7.1.24-

7.1.26, 7.1.40, 7.1.45), for the next detonation SouthCoast must implement the following measures as applicable:

1. Attenuation Measures: SouthCoast must implement one or more additional, modified, and/or alternative noise attenuation measures or other changes to the detonation plans (e.g., add noise attenuation device, adjust noise mitigation system, as described in the *SFV Plan*) that are expected to reduce sound levels to the modeled distances (assuming 10 dB attenuation). These measures must be implemented for the next detonation. SouthCoast must provide written notification to BOEM, BSEE, USACE, of the changes planned for the next detonation at least 24 hours in advance of planned implementation.

2. Clearance Zones. Clearance zones must be increased to reflect the results of SFV. For every 1,500 m that a marine mammal clearance zone is expanded, additional PSOs must be deployed from additional platforms to ensure adequate and complete monitoring of the expanded clearance zone, with each PSO responsible for scanning no more than 120 degrees out to a radius no greater than 1,500 m; SouthCoast must deploy any additional PSOs consistent with the approved monitoring plan for UXO detonations in consideration of the size of the new zones and the species that must be monitored (i.e., sea turtles and/or whales). Use of the expanded zones must continue for additional detonations until SouthCoast requests and receives concurrence from NMFS GARFO to revert to the original clearance zones.

- If SouthCoast determines that no additional measures or modifications are feasible for implementation following a UXO detonation where Thorough SFV measurements indicate that the distances to any identified isopleth of concern are greater than those modeled assuming 10 dB attenuation (see Tables 7.1.24-7.1.26, 7.1.40, 7.1.45), SouthCoast will notify NMFS within 24 hours of making that determination. NMFS GARFO, NMFS OPR, BOEM, BSEE, and USACE will meet within three business days of that notification (or on another timeline that ensures enough time before the next planned detonation) to discuss: the results of SFV monitoring, the severity of exceedance of distances to identified isopleths of concern, the species affected, modeling assumptions, the potential for similar exceedances to occur during future planned detonations, and whether any triggers for reinitiation of consultation are met (50 CFR 402.16), including consideration of whether the SFV results constitute new information revealing effects of the action that may affect listed species in a manner or to an extent not previously considered in the consultation. During that period, detonations must be delayed unless a delay would create an imminent risk to human life or safety.

d. **SFV Reports (UXO/MEC).** SouthCoast must submit a SFV report for each UXO/MEC detonation. Each report must be submitted as soon as possible and in all cases must be submitted within 30 days of the detonation and at least 72 hours prior any planned subsequent detonations. SFV Reports must contain the content required by the conditions of the final MMPA ITA as well as the measured ranges to the injury and behavioral disturbance thresholds for sea turtles and fish.

4. To implement the requirements of RPM 1 and 2, BOEM, BSEE, and/or USACE must require that SouthCoast inspect and carry out appropriate maintenance on the noise attenuation system prior to every foundation installation event (i.e., for each pile driven foundation) and prior to every UXO detonation consistent with the maintenance protocols identified below, and prepare and submit a Noise Attenuation System (NAS) inspection/performance report to NMFS GARFO and NMFS OPR. For piles for which Thorough SFV is carried out this report must be submitted as soon as it is available, but no later than when the interim SFV report is submitted for the respective pile. For all UXO detonations, this report must be submitted with the SFV report for the detonation. Performance reports for piles with Abbreviated SFV must be submitted with the weekly pile driving reports. All reports must be submitted by email to nmfs.gar.incidental-take@noaa.gov and submitted to BSEE through TIMSWeb.

   a. SouthCoast must develop and implement a NAS maintenance plan that identifies the frequency of hose inspection, flushing, pressure tests, and re-drilling and that is designed to minimize the potential for sediment clogging to affect bubble curtain performance. Adjustments to the frequency of these maintenance steps must be made as necessary to ensure optimal performance of the bubble curtain system. Compliance with these steps must be documented in the performance reports.

   b. Performance reports for each bubble curtain deployed must include water depth, current speed and direction, wind speed and direction, bubble curtain deployment/retrieval date and time, bubble curtain hose length, bubble curtain radius (distance from pile), diameter of holes and hole spacing, air supply hose length, compressor type (including rated Cubic Feet per Minute (CFM) and model number), number of operational compressors, performance data from each compressor (including Revolutions Per Minute (RPM), pressure, start times, and stop times), free air delivery (m^3/min), total hose air volume (m^3/(min m)), schematic of GPS waypoints during hose laying, maintenance procedures performed (pressure tests, inspections, flushing, re-drilling, and any other hose or system maintenance) before and after installation and timing of those tests, and the length of time the bubble curtain was on the seafloor prior to foundation installation. Additionally, the report must include any important observations regarding performance (before, during, and after pile installation or UXO detonation), such as any observed weak areas of low pressure. The report may also include any relevant video and/or photographs of the bubble curtain(s) operating during pile driving/UXO detonation.

5. To implement the requirements of RPM 3, BOEM, BSEE, and/or USACE must require and SouthCoast must implement a monitoring plan that is sufficient to evaluate the full extent of hydrodynamic wake effects from all SouthCoast foundations.

   - The plan must contain all parameters necessary to allow for an evaluation of whether the extent of hydrodynamic wake effects in a given year, considering seasonal and other variability, are greater than considered in this Opinion (i.e., exceed 1,800 m at any foundation monitored and/or exceed an average of 1,000 m across all foundations monitored).
     - The plan may include a pilot period to evaluate technology or feasibility of proposed monitoring approaches.
     - The plan may include monitoring a subset of foundations, provided such monitoring would allow for an assessment of hydrodynamic wake effects from all foundations.
     - The plan must describe the frequency of monitoring (i.e., within an annual period to capture seasonal variability over the life of the project). The plan may include an initial monitoring period, which must cover at least the first 3-years following completion of all foundation installation (unless an alternative initial monitoring period is justified by SouthCoast and agreed to by NMFS), followed by a plan for reduced monitoring frequency that would be implemented if the plan and associated monitoring reports can demonstrate that it is reasonable to expect that the identified monitoring frequency would be sufficient for the purposes of implementing the RPM.
   - SouthCoast must submit a draft plan to NMFS GARFO (nmfs.gar.incidental-take@noaa.gov) within 1 year of issuance of this Opinion. NMFS GARFO will provide comments and confer with SouthCoast as necessary during the development and review of the draft plan. Factors that would influence implementation of the plan including availability of technology/equipment, feasibility, practicality, and limitations of potential monitoring techniques will be considered during plan development.
     - Development of this monitoring plan should be done in consideration of local and regional scale evaluations of impacts of hydrodynamic impacts of offshore wind development. Opportunities to incorporate data or evaluation from complementary studies, including modeling, should be identified in the draft plan.
   - Consistent with the requirements for other monitoring plans (see Term and Condition 12), BOEM, BSEE, and SouthCoast must obtain NMFS GARFO's concurrence with this Plan (i.e., that the plan is sufficient to evaluate the full extent of hydrodynamic wake effects from all SouthCoast foundations) prior to September 1 of the first year of pile driving (or of the year when monitoring will begin if there has been an agreement to delay the start of monitoring). This timing is designed to ensure that an approved monitoring plan is in place before the required monitoring period begins.

- Monitoring (i.e., implementation of an approved plan) must begin on December 1 following the first foundation installation season (i.e., if foundation installation occurs prior to December in 2027, monitoring must begin on December 1, 2027) unless SouthCoast can demonstrate that monitoring could not be effectively implemented while construction/installation is ongoing, in which case SouthCoast must commence monitoring at the soonest date practicable following completion of construction/installation. The December 1 requirement will remain effective unless SouthCoast requests and NMFS GARFO agrees to an alternative start date.
- Monitoring reports must be submitted at least annually to NMFS GARFO (nmfs.gar.incidental-take@noaa.gov), with draft reports to be submitted for review and comment no later than March 15 of each year. Monitoring reports must contain information sufficient to support an evaluation as to whether the amount or extent of take of North Atlantic right whales has been exceeded.
- During any pilot and/or initial monitoring period, a meeting with NMFS GARFO, BOEM, BSEE, USACE, and SouthCoast Wind must be held within 60 days of submission of the annual monitoring report to review the results, evaluate whether there is any indication that the amount/extent of incidental take has been exceeded (i.e., if effects are greater than previously analyzed), and discuss any improvements or changes that could be implemented for the upcoming monitoring season.

5. To implement the requirements of RPM 4, BOEM, BSEE, and/or USACE must require that SouthCoast prepare and submit interim and final SFV reports to NMFS GARFO (via email) and BSEE (via TIMSWeb) as outlined here:
    a. **Interim SFV Reports - Foundation Installation.** BOEM, BSEE, and USACE must require SouthCoast to provide the initial results of the SFV measurements to NMFS GARFO and NMFS OPR in an interim report as soon as it is available but no later than 48 hours after the installation of each pile for which Thorough SFV is carried out. If technical or other issues prevent submission within 48 hours, SouthCoast must notify BOEM, BSEE, and NMFS GARFO within that 48-hour period with the reasons for delay and provide an anticipated schedule for submission of the report. The interim report must include data from hydrophones identified for interim reporting in the *SFV Plan* and include a summary of pile installation activities (pile diameter, pile weight, pile length, water depth, sediment type, hammer type, total strikes, total installation time [start time, end time], duration of pile driving, max single strike energy, NAS deployments), pile location, recorder locations, modeled and measured distances to thresholds, received levels (rms, peak, and SEL) results from Conductivity, Temperature, and Depth (CTD) casts/sound velocity profiles, signal rise time and kurtosis, pile driving plots, activity logs, weather conditions, baseline pre- and post-activity ambient/background sound levels (broadband and/or within frequencies of concern) recorded over a 30 minute period prior to and 30 minute period after pile driving. Additionally, any important sound attenuation device malfunctions (suspected or definite), must be summarized and substantiated with data (e.g.

photos, positions, environmental data, directions, etc.). Such malfunctions include gaps in the bubble curtain, significant drifting of the bubble curtain, and any other issues which may indicate sub-optimal mitigation performance or are used by SouthCoast to explain performance issues. Requirements for actions to be taken based on the results of the SFV are identified in T&C 2 and 3 above.

b. In addition to the requirements above, all Thorough SFV reports for foundation installation must include the associated Estimated Received Level(s) derived from the Thorough SFV results, calculated consistent with the methods described in the approved *SFV Plan*. The Estimated Received Levels (ERLs) derived from Thorough SFV results will be used for evaluating results of Abbreviated SFV.

c. All Abbreviated SFV reports must include the results from the hydrophones at 750m and a comparison to the expected levels at 750 m based on the previously completed thorough SFV for comparable pile type and installation method. Abbreviated SFV reports must be submitted with the weekly pile driving report.

d. **Final SFV Reports (Pile Driving) -** The final SFV report (including both Thorough and Abbreviated SFV results) for all monopile and pin pile installations must be submitted as soon as possible, but no later than within 90 days following installation of the last foundation of a given construction season. Final SFV Reports must contain the content required by the conditions of the final MMPA ITA as well as the measured ranges to the injury and behavioral disturbance thresholds for sea turtles and fish.

6. To implement the requirements of RPM 4, BOEM, BSEE, and/or USACE must require that SouthCoast file a report with NMFS GARFO (nmfs.gar.incidental-take@noaa.gov) and BSEE (via TIMSWeb and notification email to protectedspecies@bsee.gov) in the event that any ESA listed species is observed within the relevant identified shutdown zone (see Table 11.1) during active pile driving (vibratory or impact). This report must be filed within 48 hours of the incident and include the following: description of the activity (i.e., vibratory or impact pile driving) and duration of pile driving prior to the detection of the animal(s), location of PSOs and any factors that impaired visibility or detection ability, time of first and last detection of the animal(s), distance of animal at first detection, closest point of approach of animal to pile, behavioral observations of the animal(s), time the PSO called for shutdown, hammer log (number of strikes, hammer energy), time the pile driving began and stopped, and any measures implemented (e.g., reduced hammer energy) prior to shutdown. If shutdown was determined not to be feasible, the report must include an explanation for that determination and the measures that were implemented (e.g., reduced hammer energy).

7. To implement the requirements of RPM 4, BOEM, BSEE, USACE, must require SouthCoast to implement the following reporting requirements necessary to document the amount or extent of incidental take that occurs during all phases of the proposed action. Unless otherwise specified all reports must be submitted to NMFS GARFO via e-mail (nmfs.gar.incidental-take@Noaa.gov) and BSEE via TIMSWeb. In the event that no activities occurred in an identified reporting period, a simplified report in the form of an email stating that no activities occurred in the reporting period can be substituted for the otherwise required report.

a. All observations or interactions with sea turtles or sturgeon that occur during the fisheries monitoring surveys must be reported within 48 hours to NMFS GARFO Protected Resources Division by email (nmfs.gar.incidental-take@noaa.gov). Take reports should reference the SouthCoast project and include the Take Report Form available on NMFS webpage (https://media.fisheries.noaa.gov/2021-07/Take%20Report%20Form%2007162021.pdf?null). Reports of Atlantic sturgeon take must include a statement as to whether a fin clip sample for genetic sampling was taken. Fin clip samples are required in all cases of interactions and handling of Atlantic sturgeon to document the DPS of origin; the only exception to this requirement is when additional handling of the sturgeon would result in an imminent risk of injury to the fish or the survey personnel handling the fish; we expect such incidents to be limited to capture and handling of sturgeon in extreme weather. Instructions for fin clips and associated metadata are available at https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-take-reporting-programmatics-greater-atlantic, under the "Sturgeon Genetics Sampling" heading.

b. All sightings and acoustic detections of North Atlantic right whales must be reported immediately (no later than 24 hours). PAM detections and sightings of right whales with no visible injuries or entanglement must be reported as described in (i) below. Reporting requirements for suspected vessel strikes and injured/dead right whales are in (c) and (d) below.

- If a NARW is sighted with no visible injuries or entanglement or is detected via PAM at any time by project PSOs/PAM Operators or project personnel, SouthCoast must immediately report the sighting or acoustic detection to NMFS; if immediate reporting is not possible, the report must be submitted as soon as possible but no later than 24 hours after the initial sighting or acoustic detection.
    - To report the sighting or acoustic detection, download and complete the Real-Time North Atlantic Right Whale Reporting Template spreadsheet found here: https://www.fisheries.noaa.gov/resource/document/template-datasheet-real-time-north-atlantic-right-whale-acoustic-and-visual. Save the spreadsheet as a .csv file and email it to NMFS NEFSC-PSD (ne.rw.survey@noaa.gov), NMFS GARFO (nmfs.gar.incidental-take@noaa.gov), and NMFS OPR (PR.ITP.MonitoringReports@noaa.gov).
    - If unable to report a sighting through the spreadsheet within 24 hours, call the relevant regional hotline (Greater Atlantic Region [Maine through Virginia] Hotline 866-755-6622; Southeast Hotline 877-WHALE-HELP) with the observation information provided below (PAM detections are not reported to the Hotline).
    - Observation information: Report the following information: the time (note time format), date (MM/DD/YYYY), location (latitude/longitude in decimal degrees; coordinate system used) of the observation, number of whales, animal description/certainty of observation (follow

up with photos/video if taken), reporter's contact information, and lease area number/project name, PSO/personnel name who made the observation, and PSO provider company (if applicable) (PAM detections are not reported to the Hotline).

- If unable to report via the template or the regional hotline, enter the sighting via the WhaleAlert app (http://www.whalealert.org/). If this is not possible, report the sighting to the U.S. Coast Guard via channel 16. The report to the Coast Guard must include the same information as would be reported to the Hotline (see above). PAM detections are not reported to WhaleAlert or the U.S. Coast Guard.

c. In the event of a suspected or confirmed vessel strike of any ESA listed species (e.g. marine mammal, sea turtle, listed fish) by any vessel associated with the Project or other means by which project activities caused a non-auditory injury or death of a ESA listed species, SouthCoast must immediately report the incident to NMFS (at the phone numbers and email addresses identified below) and BSEE (via TIMSWeb and notification email to (protectedspecies@bsee.gov). Reports to NMFS must be made by phone and email:

- Phone: If in the Greater Atlantic Region (ME-VA): the NMFS Greater Atlantic Stranding Hotline (866-755-6622); in the Southeast Region (NC-FL): the NMFS Southeast Stranding Hotline (877-942-5343).
- Email: GARFO (*nmfs.gar.incidental-take@noaa.gov*), and if in the Southeast region (NC-FL), also to NMFS SERO (*secmammalreports@noaa.gov*) The report must include: (A) Time, date, and location (coordinates) of the incident; (B) Species identification (if known) or description of the animal(s) involved (i.e., identifiable features including animal color, presence of dorsal fin, body shape and size); (C) Vessel strike reporter information (name, affiliation, email for person completing the report); (D) Vessel strike witness (if different than reporter) information (name, affiliation, phone number, platform for person witnessing the event); (E) Vessel name and/or MMSI number; (F) Vessel size and motor configuration (inboard, outboard, jet propulsion); (G) Vessel's speed leading up to and during the incident; (H) Vessel's course/heading and what operations were being conducted (if applicable); (I) Part of vessel that struck whale (if known); (J) Vessel damage notes; (K) Status of all sound sources in use; (L) If animal was seen before strike event; (M) behavior of animal before strike event; (N) Description of avoidance measures/requirements that were in place at the time of the strike and what additional measures were taken, if any, to avoid strike; (O) Environmental conditions (*e.g.*, wind speed and direction, Beaufort sea state, cloud cover, visibility) immediately preceding the strike; (P) Estimated (or actual, if known) size and length of animal that was struck; (Q) Description of the behavior of the marine mammal immediately preceding and following the strike; (R) If available, description of the presence and behavior of any other marine mammals immediately preceding the strike; (S) Other animal details if known (e.g., length, sex, age class); (T) Behavior or estimated fate of the animal post-strike (*e.g.*, dead, injured but alive, injured and moving, external visible wounds (linear wounds, propeller wounds, non-cutting blunt-force

trauma wounds), blood or tissue observed in the water, status unknown, disappeared); (U) To the extent practicable, photographs or video footage of the animal(s); and (V) Any additional notes the witness may have from the interaction. For any numerical values provided (i.e., location, animal length, vessel length etc.), please provide if values are actual or estimated.

d. In the event that any PSO or other project personnel, including any project vessel operator or crew, observe or identify a stranded, entangled, injured, or dead ESA listed species (e.g. marine mammal, sea turtle, listed fish), SouthCoast must immediately report the observation to NMFS (by phone (marine mammals and turtles only) and email (marine mammal, sea turtle, listed fish) and BSEE (via TIMSWeb and notification email to (protectedspecies@bsee.gov):

- Phone: If in the Greater Atlantic Region (ME-VA): NMFS Greater Atlantic Stranding Hotline (866-755-6622); in the Southeast Region (NC-FL) call the NMFS Southeast Stranding Hotline (877-942-5343). Note, the stranding hotline may request the report be sent to the local stranding network response team.
- Email: if in the Greater Atlantic region (ME to VA) to GARFO (nmfs.gar.incidental-take@noaa.gov) or if in the Southeast region (NC-FL) to NMFS SERO (secmammalreports@noaa.gov). The report must include: (A) Contact information (name, phone number, etc.), time, date, and location (coordinates) of the first discovery (and updated location information if known and applicable); (B) Species identification (if known) or description of the animal(s) involved; (C) Condition of the animal(s) (including carcass condition if the animal is dead); (D) Observed behaviors of the animal(s), if alive; (E) If available, photographs or video footage of the animal(s); and (F) General circumstances under which the animal was discovered. Staff responding to the hotline call will provide any instructions for handling or disposing of any injured or dead animals, which may include coordination of transport to shore, particularly for injured sea turtles.

e. SouthCoast must compile and submit **weekly reports** during each month that foundation installation occurs that document: the foundation/pile ID, type of pile, pile diameter, start and finish time of each pile driving event, hammer log (number of strikes, max hammer energy, duration of piling) per pile, any changes to noise attenuation systems and/or hammer schedule, details on the deployment of PSOs and PAM operators, including the start and stop time of associated observation periods by the PSOs and PAM Operators, and a record of all observations/detections of marine mammals and sea turtles including time (UTC) of sighting/detection, species ID, behavior, distance (meters) from vessel to animal at time of sighting/detection (meters), animal distance (meters) from pile installation vessel, vessel/project activity at time of sighting/detection, platform/vessel name, and mitigation measures taken (if any) and reason. Sightings/detections during pile driving activities (clearance, active pile driving, post-pile driving) and all other (transit, opportunistic, etc.) sightings/detection must be reported and identified as such. The weekly reports must also confirm that the required SFV was carried out for each pile and that results were reviewed on the required timelines. Abbreviated SFV reports and NAS performance reports must be submitted with the weekly report. These weekly reports must be submitted to NMFS GARFO (nmfs.gar.incidental-take@noaa.gov), BOEM, and BSEE by SouthCoast or the PSO providers and can consist of QA/QC'd raw data. Weekly reports are due on Wednesday for the activities occurring the previous week (Sunday – Saturday, local time).

f. SouthCoast must compile and submit reports following any UXO/MEC detonation that provide details on the UXO/MEC that was detonated (e.g., charge size), location of the detonation, the start and stop of associated observation periods by the PSOs and PAM Operators, details on the deployment of PSOs and PAM Operators, and a record of all observations of marine mammals and sea turtles including time (UTC) of sighting/detection, species ID, behavior, distance (meters) from vessel to animal at time of sighting/detection, vessel activity, platform/vessel name, and mitigation measures taken (if any). This must include any observations of dead or injured fish or other marine life in the post detonation monitoring period. These reports must be submitted to NMFS GARFO (nmfs.gar.incidental-take@noaa.gov), BOEM, and BSEE by SouthCoast or the PSO providers and can consist of QA/QC'd raw data. Reports must be submitted within one week of the detonation, with reports of dead or injured ESA listed species required to be submitted immediately, but no later than 24 hours following the observation.

g. Starting in the first month that in-water activities occur (e.g., cable installation, fisheries surveys), SouthCoast must compile and submit **monthly reports** that include a summary of all project activities carried out in the previous month, including dates and location of any fisheries surveys carried out, vessel transits (name, type of vessel, number of transits, vessel activity, and route (origin and destination, including transits from all ports, foreign and domestic)), cable installation activities (including sea to shore transition), number of foundations installed and pile IDs, UXO detonation, and all sightings/detections of ESA listed whales, sea turtles, and sturgeon. Sightings/detections must include species ID, time, date, initial detection distance, vessel/platform name, vessel activity, vessel speed, bearing to animal, project activity, and any mitigation measures taken as a result of those observations. These reports must be submitted to NMFS GARFO (nmfs.gar.incidental-take@noaa.gov) and BSEE (TIMSWeb and protectedspecies@bsee.gov) and are due on the 15th of the month for the previous month.

h. SouthCoast must submit a copy of the annual marine mammal monitoring report required by the MMPA ITA to NMFS GARFO (nmfs.gar.incidental-take@noaa.gov). Additionally, SouthCoast must submit a complementary report that addresses sea turtles; this may be a separate report or included in the same report. These reports are required to be submitted no later than March 31, annually for each calendar year that foundation installation activities occur. The report must detail the following: the total number of marine mammals and sea turtles of each species detected and how many were within the relevant clearance, behavioral harassment/disturbance, and shutdown zones and a comparison with the number of exempted takes of marine mammals and sea turtles for the associated activity type; marine mammal and sea turtle detections and behavioral observations before, during, and after each activity; what mitigation measures were implemented (i.e., number of shutdowns or clearance zone delays, etc.) or, if no mitigative actions was taken, why; operational details (i.e., days and duration of impact and vibratory pile driving, number of UXO/MEC detonations, days and amount of HRG survey effort, etc.); PAM systems used; the results/detections, effectiveness, and which noise attenuation systems were used during relevant activities (i.e., foundation pile driving); summarized information related to situational reporting; and any other important information relevant to the Project. If any other listed species were observed during the reporting period, this information must be included in the report.

i. SouthCoast must submit to NMFS GARFO (nmfs.gar.incidental-take@noaa.gov) an annual report describing all activities carried out to implement their Fisheries Research and Monitoring Plan. This report must include a summary of all activities conducted, the dates and locations of all fisheries surveys, including location and duration for all trawl surveys summarized by month, number of vessel transits inclusive of port of origin and destination, and a summary table of any observations and captures of ESA listed species during these surveys. The report must also summarize all acoustic telemetry and benthic monitoring activities that occurred, inclusive of vessel transits. Each annual report is due by February 15 (i.e., the report for 2025 activities is due by February 15, 2026).

j. BOEM and BSEE must require SouthCoast to submit full detection data, metadata, and location of recorders (or GPS tracks, if applicable) from all real-time hydrophones used for monitoring during construction within 90 calendar days after the completion of foundation installation and UXO detonations have ended for the calendar year (i.e., if the last foundation of construction year 1 is installed on November 30, the report is due by March 1 of the following year). Reporting must use the webform templates on the NMFS Passive Acoustic Reporting System website at *https://www.fisheries.noaa.gov/resource/document/passive-acoustic-reporting-system-templates*. BOEM and BSEE must require SouthCoast to submit the full acoustic recordings from all the real-time hydrophones to the National Centers for Environmental Information (NCEI) for archiving within 90 calendar days after pile-driving has ended and instruments have been pulled from the water. Archiving guidelines outlined here (https://www.ncei.noaa.gov/products/passive-acoustic-data#tab-3561) must be followed. Confirmation of both submittals must be sent to NMFS GARFO via email (nmfs.gar.incidental-take@noaa.gov).

8. To implement the requirements of RPM 4 and to facilitate monitoring of the incidental take exemption for sea turtles, BOEM, BSEE and/or SouthCoast must submit an annual report prepared by SouthCoast and reviewed by BOEM and/or BSEE that estimates the total number of sea turtle vessel strikes in the action area that would be attributable to SouthCoast vessel operations. This report must use the best available information on sea turtle presence, distribution, and abundance, project vessel activity, and observations to

estimate the total number of sea turtle vessel strikes in the action area that are attributable to project operations. Each annual report is due by February 15 (i.e., the report for 2025 activities is due by February 15, 2026).

9. To implement the requirements of RPM 4, within 10 business days of BOEM, BSEE, and/or USACE obtaining updated information on project plans (e.g., as obtained through a relevant Facility Design Report (FDR) and/or Fabrication and Installation Report (FIR), or other submission), BOEM, BSEE, and/or USACE must provide NMFS GARFO (nmfs.gar.incidental-take@noaa.gov) with the following information: number, size, and type of foundations to be installed to support wind turbine generators and electrical service platforms for each project; the proposed construction schedule (i.e., months when pile driving is planned) for each project, and any available updates on anticipated vessel transit routes (e.g., any changes to the ports identified for use by project vessels, confirmation of location of O&M facility) that will be used by project vessels. This information may be provided in separate submissions for Project 1 and Project 2. NMFS GARFO will review this information and, to the maximum extent practicable, within 10 business days of receipt will request a meeting with BOEM, BSEE, and USACE if there is any indication that there are changes to the proposed action that would cause an effect to listed species or critical habitat that was not considered in this Opinion, including the amount or extent of predicted take, such that any potential trigger for reinitiation of consultation can be discussed with the relevant action agencies.

10. To implement RPM 4 for trawl surveys:
    a. At least one of the survey staff onboard the trawl survey vessels must have completed NMFS Northeast Fisheries Observer Program (NEFOP) training within the last 5 years or other training in protected species identification and safe handling (inclusive of taking genetic samples from Atlantic sturgeon); documentation of training must be submitted to NMFS GARFO at least 7 calendar days prior to the start of the trawl surveys and at any later time that a different NEFOP trained observer is deployed on the survey.
    b. If SouthCoast or their contractors will deploy non-NEFOP trained survey personnel in lieu of NEFOP-trained observers, BOEM, BSEE, and/or SouthCoast must submit a plan to NMFS describing the training that will be provided to those survey observers. This *Observer Training Plan for Trawl Surveys* must be submitted as soon as possible after issuance of this Opinion but no later than 30 calendar days prior to the start of trawl surveys for which a non-NEFOP trained observer will be deployed. BOEM, BSEE, and SouthCoast must obtain NMFS GARFO's concurrence that the observer training plan meets the requirements identified here prior to the deployment of the non-NEFOP trained observer on any trawl surveys. This plan must include a description of the elements of the training (i.e., curriculum, virtual or hands on, etc.) and identify who will carry out the training and their qualifications. Once the training is complete, confirmation of the training and a list of trained survey staff must be submitted to NMFS; this list must be updated if additional staff are trained for future surveys. In all cases, a list of trained survey staff must be submitted to NMFS at least one business day prior to the beginning of the survey.

11. To implement RPM 5, BOEM, BSEE, and/or USACE must require, and SouthCoast must prepare and submit the plans identified below in sufficient time to allow for review, resolution of comments, and any required concurrence prior to the planned start date for the associated activities. All plans must be submitted to NMFS GARFO at nmfs.gar.incidental-take@noaa.gov as well as to BOEM (renewable_reporting@boem.gov), BSEE (via TIMSWeb with a notification email to protectedspecies@bsee.gov), and USACE (cenae-r-@usace.army.mil).

- Any of the identified plans can be combined such that a single submitted plan addresses multiple requirements provided that the plan clearly identifies which requirements it is addressing.
- Within 90 days of issuance of this Biological Opinion, BOEM must schedule a meeting between SouthCoast and NMFS GARFO to review the plan requirements, discuss the review/concurrence process, and develop a schedule for when plans can be expected to be submitted for review.
- Between 30 and 90 days before the planned start of foundation installation each year, SouthCoast must meet with NMFS GARFO, BOEM, BSEE, USACE, and NMFS OPR to review the construction plans and schedule for the upcoming construction season, and review requirements for reporting and notification protocols, and Thorough and Abbreviated SFV requirements.
- Additional meetings may be requested by NMFS GARFO as necessary to ensure adequate coordination on plan development, including meetings at the end of each construction season. BOEM must require that SouthCoast participate in any such meetings.
- All plans must be submitted at least 180 days in advance of the planned start of relevant activities (e.g., the foundation installation monitoring plan must be submitted at least 180 days before the planned date for installation of the first pile). In the event that SouthCoast requires concurrence from the agencies at an earlier date (e.g., to support procurement of equipment), SouthCoast must submit the plan(s) with enough time to allow for at least 180 days prior to the requested concurrence date. For each plan, within 45 calendar days of receipt of the plan, NMFS GARFO will provide comments to BOEM, BSEE, and SouthCoast, including a determination as to whether the plan is consistent with the requirements outlined in this ITS and/or in Section 3 of this Opinion. If the plan is complete and is determined to be consistent with the identified requirements, NMFS GARFO will provide concurrence that the plan meets the identified requirements. If the plan is determined to be inconsistent with these requirements (e.g., if required information is missing), SouthCoast must resubmit a modified plan that addresses the identified issues within 30 days of the receipt of the comments. For all subsequent drafts, SouthCoast must provide for at least 10 day calendar days for review and comment. BOEM must work with SouthCoast to ensure that subsequent drafts of each plan are provided to NMFS with adequate time to carry out a thorough review, and any necessary concurrence, prior to the associated activity taking place.

   a. **Marine Mammal and Sea Turtle Monitoring Plan – Foundation Installation and UXO/MEC detonation.** BOEM, BSEE, and/or SouthCoast must submit this Plan (or Plans if separate plans are prepared for foundation installation and UXO/MEC detonation) to NMFS GARFO at least 180 calendar days before the respective activity is planned to begin (i.e., if foundation installation or UXO detonation is planned for May 1, the plan must be submitted no later than November 1 of the preceding year). BOEM, BSEE, and SouthCoast must obtain NMFS GARFO's concurrence with this Plan(s) prior to the start of any pile driving for foundation installation and before any UXO/MEC detonation.

- The Plan(s) must include: a description of how all relevant mitigation and monitoring requirements contained in the incidental take statement and those included as part of the proposed action will be implemented; a pile driving installation summary and sequence of events; a description of all monitoring equipment and evidence (i.e., manufacturer's specifications, reports, testing) that it can be used to effectively monitor and detect ESA listed marine mammals and sea turtles in the identified clearance and shutdown zones (i.e., field data demonstrating reliable and consistent ability to detect ESA listed large whales and sea turtles at the relevant distances in the conditions planned for use); communications and reporting details; and PSO monitoring and mitigation protocols (including number of PSOs, number of PSO platforms, and planned location of PSO platforms in relation to the pile or UXO) for effective observation and documentation of sea turtles and ESA listed marine mammals during all foundation installation events and UXO/MEC detonations.
- The Plan(s) must demonstrate sufficient PSO and PAM Operator staffing (in accordance with watch shifts), PSO and PAM Operator schedules, and contingency plans for instances if additional PSOs and PAM Operators are required including any expansion of clearance and/or shutdown zones that may be required as a result of SFV.
- The Plan(s) must address monitoring during reduced visibility conditions. It must contain a thorough description of how SouthCoast will monitor foundation installation activities (vibratory and impact pile driving) during reduced visibility conditions (e.g. rain, fog) and in other low visibility conditions (e.g., if pile driving is started during the day and unexpectedly continues after dark), including proof of the efficacy of monitoring devices (e.g., mounted thermal/infrared camera systems, hand-held or wearable night vision devices NVDs, spotlights) in detecting ESA listed marine mammals and sea turtles over the full extent of the required clearance and shutdown zones, including demonstration that the full extent of the minimum visibility zones can be effectively and reliably monitored. The Plan must identify the efficacy of the technology at detecting marine mammals and sea turtles in the clearance and shutdown zones under all the various conditions anticipated during construction, including varying weather conditions, sea states, and in consideration of the use of artificial lighting.
- The plan must describe how SouthCoast would determine the number of sea turtles exposed to noise above the 175 dB harassment threshold during foundation installation and how SouthCoast would determine the number of ESA listed whales exposed to noise above the Level B harassment threshold during foundation installation and UXO detonation (in consideration of modeling that indicates that distances to the Level B harassment threshold

may extend beyond the clearance and shutdown zones being monitored by PSOs).

b. **Nighttime Monitoring Plan – Foundation Installation.** If SouthCoast seeks to conduct pile driving initiated after dark, BOEM, BSEE, and/or SouthCoast must submit a *Nighttime Monitoring Plan* to NMFS GARFO at least 180 calendar days before night time foundation installation is planned to begin. Night time foundation installation or night time pile driving refers to pile driving (vibratory or impact) initiated after dark (i.e., from 1.5 hours before civil sunset to 1 hour after civil sunrise). BOEM, BSEE, and SouthCoast must obtain NMFS GARFO's concurrence with this Plan(s) prior to the start of any night time pile driving for foundation installation. This plan can be included as a sub-section of the Marine Mammal and Sea Turtle Monitoring Plan addressed above or as a stand-alone plan.

- This Plan(s) must contain a thorough description of how SouthCoast will monitor foundation installation activities at night, including proof of the efficacy of monitoring devices (e.g., mounted thermal/infrared camera systems, hand-held or wearable night vision devices NVDs, spotlights) in detecting ESA listed marine mammals and sea turtles over the full extent of the required clearance and shutdown zones, including demonstration that the full extent of the minimum visibility zones (see Table 11.1) can be effectively and reliably monitored at night.
- The Plan must identify the efficacy of the technology at detecting marine mammals and sea turtles in the clearance and shutdown zones under all the various conditions anticipated during construction, including varying weather conditions, sea states, and in consideration of the use of artificial lighting. The plan must include a description of how the effective distance of detection will be ground-truthed with known objects at known distances prior to pile driving.
- If the plan does not include a full description of the proposed technology, monitoring methodology, and data demonstrating to NMFS GARFO's satisfaction that marine mammals and sea turtles can reliably and effectively be detected within the clearance and shutdown zones for monopiles and jacket foundations before and during foundation installation, nighttime foundation installation may not occur; the only exception would be if safety necessitates continuing pile installation after dark for a foundation that was initiated 1.5 hours prior to civil sunset, in which case the Reduced Visibility components of the Pile Driving Monitoring Plan (see 13.a) would be implemented.

i. As a component of the Nighttime Pile Driving Monitoring Plan, for the first three piles installed after dark, SouthCoast must submit interim reports on the effectiveness of PSO monitoring during pile driving initiated after dark. This interim report must be submitted via email to NMFS GARFO within 48 hours of completion of each of the first three piles installed after dark, and before any additional pile driving after dark is initiated, and must include a description of the equipment used by the PSOs, the on-water effective distances for detection, any issues identified during pile driving, and any adjustments or additions planned for subsequent piles initiated after dark (as described in the Nighttime Pile Driving Monitoring Plan). NMFS GARFO will review the report and provide any feedback including recommendations for modifications that may be necessary to ensure effective monitoring by the visual PSOs of the minimum visibility, clearance, and shutdown zones.

c. **Passive Acoustic Monitoring Plan for Pile Driving and UXO/MEC Detonation.** BOEM, BSEE, and/or SouthCoast must submit this Plan (or Plans if separate Foundation Installation and UXO/MEC plans are prepared) to NMFS GARFO at least 180 calendar days before either Pile Driving or UXO/MEC detonation is planned. This plan can be included as a sub-section of the Marine Mammal and Sea Turtle Monitoring Plan addressed above. BOEM, BSEE, and SouthCoast must obtain NMFS GARFO's concurrence that this Plan meets the requirements outlined here prior to the start of any foundation installation or UXO/MEC Detonation. The Plan must include a description of all proposed PAM equipment and hardware, the calibration data, bandwidth capability and sensitivity of hydrophones, and address how the proposed passive acoustic monitoring will follow standardized measurement, processing methods, reporting metrics, and metadata standards for offshore wind (Van Parijs *et al.,* 2021). The Plan must describe and include all procedures, documentation, and protocols including information (i.e., testing, reports, equipment specifications) to support that it will be able to detect vocalizing whales within the clearance and shutdown zones, including deployment locations, procedures, detection review methodology, and protocols; hydrophone detection ranges with and without noise associated with foundation installation/construction activities and data supporting those ranges; communication time between call and detection, and data transmission rates between PAM Operator and PSOs; where PAM Operators will be stationed relative to hydrophones and PSOs stationed on vessels calling for delay/shutdowns; and a full description of all proposed software, call detectors, and filters. The Plan must also incorporate the requirements relative to North Atlantic right whale reporting in T&C 8.

d. **Sound Field Verification Plan - Foundation Installation and UXO/MEC Detonation.** BOEM, BSEE, and USACE must require SouthCoast to submit this Plan (or Plans if separate Foundation Installation and UXO/MEC plans are prepared) to NMFS GARFO at least 180 calendar days before pile driving for foundations and UXO/MEC detonation is planned to begin. BOEM, BSEE, and SouthCoast must obtain NMFS GARFO's concurrence with this Plan(s) prior to the start of foundation installation and/or UXO detonations as applicable.
   - The Plan must detail all plans and procedures for sound attenuation, including procedures for adjusting and optimizing the noise attenuation system(s), deployment procedures and timelines, maintenance procedures and timelines, and detail the available

contingency noise attenuation measures/systems and operational changes to be implemented if distances to modeled isopleths of concern are exceeded (as documented during SFV). This must include consideration for addressing battery life, sediment build up in bubble curtain hoses, and ensuring adequate back up equipment is available. *(Pile Driving and UXO)*

- The plan must describe how SouthCoast will conduct the required Thorough SFV (T&C 2) for each of the required foundation types, installation methodologies, and locations. This must include an explanation of how the foundation sites planned for Thorough SFV are representative of all other foundation installation sites for a scenario or, if they are not, how SouthCoast will select additional foundation locations for Thorough SFV. SouthCoast must provide justification for why the foundation locations selected for Thorough SFV are representative of the scenario modeled. *(Pile Driving)*
- The plan must describe how SouthCoast will conduct the required Abbreviated SFV for pile installation, inclusive of requirements to review results within 24 hours and triggers for Thorough SFV. *(Pile Driving)*
- The plan must describe how SouthCoast will calculate Estimated Received Level(s) derived from the Thorough SFV results. This methodology should be consistent with approaches recommended by BOEM and NMFS. An appropriate methodology should produce Estimated Received Levels (ERLs) which are reasonably effective at evaluating if (1) Abbreviated SFV results represent a significant departure from Thorough SFV results or (2) Abbreviated SFV results indicate the modeled ranges to regulatory thresholds were likely exceeded. The Estimated Received Levels (ERLs) derived from Thorough SFV results will be used to evaluate the results of Abbreviated SFV.
- The Plan must provide a table of the identification number and coordinates of each foundation location, and specify the underwater acoustics analysis model scenario against which each foundation location's SFV results will be compared. *(Pile Driving)*
- The Plan(s) must also include the piling schedule and sequence of events, communication and reporting protocols, and methodology for collecting, analyzing, and preparing SFV data for submission to NMFS, including instrument deployment, locations of all hydrophones (including direction and distance from the pile), hydrophone sensitivity, recorder/measurement layout, and analysis methods. The Plan must also identify the number and distance of relative location of hydrophones for Thorough and Abbreviated SFV. *(Pile Driving)*
- The plan must include a template of the interim report to be submitted and describe the all the information that will be reported in the SFV Interim Reports including the number, location, depth, distance, and

predicted and actual isopleth distances that will be included in the final report(s). *(Pile Driving)*

- The Plan must describe how the interim SFV report results will be evaluated against the modeled results, including which modeled scenario the results will be reported against, and include a decision tree of what happens if measured values exceed predicted values. *(Pile Driving)*
- The Plan must address how SouthCoast will implement the measures associated with the required SFV which includes, but is not limited to, identifying additional or modified noise attenuation measures (e.g., additional noise attenuation device, adjust hammer operations, adjust or modify the noise mitigation system) or operational changes that will be applied if measured distances are greater than those modeled as well as implementation of any expanded clearance or shutdown zones, including deployment of additional PSOs. *(Pile Driving and UXO)*

e. ***Vessel Strike Avoidance Plan***. SouthCoast must submit this plan to NMFS GARFO no later than 180 days prior to the planned mobilization of any vessels operated by or under contract to SouthCoast for the SouthCoast project (i.e., any vessel associated with construction, operations and maintenance, or decommissioning activities described in this Opinion). The Plan must include: an acknowledgement of the vessels that are subject to the plan; all relevant mitigation and monitoring measures for listed species inclusive of a summary of all applicable vessel speed and approach restrictions in different operational areas; vessel-based observer protocols for transiting vessels; communication and reporting plans; and a description of proposed alternative monitoring equipment to allow lookouts/PSOs to observe vessel strike avoidance zones in varying weather conditions, sea states, darkness, and in consideration of the use of artificial lighting. The plan must also address procedures to be implemented when navigational or crew safety prevent adherence to vessel speed restrictions that would otherwise apply. NMFS GARFO will review this plan and identify any inconsistencies with the requirements for vessel strike avoidance required by regulation or otherwise incorporated into the proposed action considered in the Biological Opinion. With the exceptions noted below, NMFS GARFO's concurrence with this plan is not required prior to vessel mobilization.

   i. Consistent with the requirements in the proposed MMPA ITA, if SouthCoast plans to implement PAM in any transit corridor to allow vessel transit above 10 knots, SouthCoast must prepare a plan (a standalone plan or supplement to the *Vessel Strike Avoidance Plan*) that describes: the location of each transit corridor (with a map); how PAM, in combination with visual observations, will be conducted to ensure highly effective monitoring for the presence of right whales in the transit corridor; and, the protocols that will be in place for vessel speed restrictions following detection of a right whale via PAM or visual observation. This plan must be provided to NMFS GARFO for review at least 180 days in advance of planned deployment of the PAM system.

PAM information must follow what is required to be submitted for the *PAM Plan* in T&C 12.c. BOEM, BSEE, and SouthCoast must receive NMFS GARFO's concurrence that the plan is consistent with the requirements of this ITS prior to implementation of the PAM-monitored transit corridor. This plan will be reviewed in consideration of issues related to navigational and crew safety.

ii. If a separate *Vessel Strike Avoidance Plan* will be implemented after the expiration of the 5-year effective period of the MMPA ITA, it must be submitted to NMFS GARFO for review and concurrence that operation of project vessels pursuant to the proposed plan would not result in effects to any listed species not considered in this Opinion.

iii. Following the 5-year effective period of the MMPA ITA, BOEM and/or BSEE must continue to require that all vessels be equipped with a properly installed, operational Automatic Identification System (AIS) device and require that SouthCoast submit an annual update to NMFS GARFO that lists all Maritime Mobile Service Identity (MMSI) numbers for project vessels.

13. To implement the requirements of RPM 6, BOEM, BSEE, NMFS OPR, and USACE must exercise their authorities to assess the implementation of measures to minimize and monitor incidental take of ESA listed species during activities described in this Opinion. These agencies shall immediately exercise their respective authorities to take effective action to ensure prompt implementation and compliance if SouthCoast is not complying with: any avoidance, minimization, and monitoring measures incorporated into the proposed action or any term and condition(s) specified in this statement, as currently drafted or otherwise amended or modified in agreement between these agencies and NMFS; if agencies fail to do so, the protective coverage of Section 7(o)(2) may lapse.

14. To implement the requirements of RPM 6, SouthCoast must consent to on-site observation and inspections by Federal agency personnel (including NOAA personnel) during activities described in the Biological Opinion, for the purposes of evaluating the effectiveness and implementation of measures designed to minimize or monitor incidental take.

15. To implement the requirements of RPM 6, SouthCoast, BOEM, BSEE, NMFS OPR, and USACE must immediately notify NMFS GARFO of any identified or suspected non-compliance with any measure outlined in this Incidental Take Statement or in any measure incorporated into the proposed action, including measures included in the Final MMPA authorization. This includes the suspected or identified failure in effectiveness of any such measure. This notification must be submitted as soon as the issue is identified to nmfs.gar.incidental-take@noaa.gov and must include a description of the non-compliance or failure of effectiveness of the measure, the date the issue was identified, and, any corrective actions that were taken. The report of non-compliance must be followed within 48 hours with a request to meet with NMFS GARFO to discuss the report and seek concurrence from NMFS GARFO on the corrective measures. Neither the lessee nor any action agency may interfere with any reporting to NMFS by a PSO or other personnel of any identified or suspected non-compliance with any such measures or

any identified or suspected incidental take. This Term and Condition is not intended to be implemented in a manner that would interfere with any investigation or compliance/enforcement action undertaken by any action agency.

Table 11.1. Clearance and Shutdown Zones for ESA Listed Species - Pile Driving and UXO/MEC detonations

These are the PAM detection, minimal visibility, clearance and shutdown zones incorporated into the proposed action; the zones for marine mammals reflect the proposed conditions of the MMPA ITA, as modified by NMFS OPR during the consultation period, and the zones for sea turtles reflect the zone sizes proposed by BOEM. Pile driving will not proceed unless the visual PSOs can effectively monitor the full extent of the minimum visibility zones. UXO/MEC detonation will not proceed unless the entirety of the clearance zone is visible to the PSOs. Detection of an animal within the clearance zone triggers a delay of initiation of pile driving or UXO/MEC detonation; detection of an animal in the shutdown zone triggers the identified shutdown requirements. Further modification of the minimum visibility, clearance, and/or shutdown zones for marine mammals may be included in the final MMPA ITA; in which case this requirement would be amended to require compliance with the final minimum visibility, clearance, and/or shutdown zones to the extent that modified zones are more protective.

11.1.a Clearance, Shutdown, and Minimum Visibility Zones, in meters (m), during Sequential and Concurrent Installation of 9/16-m Monopiles and 4.5-m Pin Piles

Installation Order:	Sequential					Concurrent		
Pile Type:	9/16-m Monopile	4.5-m Pin Pile	9/16-m Monopile		4.5-m Pin Pile	WTG Mono + 4 OSP Pin Piles	4 WTG Pin + 4 OSP Pin Piles	
Method:	Impact Only		Impact	Vibratory	Impact	Vibratory	Impact Only	
Minimum Visibility zone[1]: Within NARW EMA: 4,800 m (pin piles); 7,400 m (monopiles). Outside NARW EMA: equivalent to blue/fin/sei whale impact pile driving clearance zone								
NARW Visual Clearance/Shutdown zone[2]	Sighting at Any Distance from PSOs on Pile-Driving or Dedicated PSO Vessels triggers a delay or shutdown (minimum visibility zone plus any additional distances observable by the visual PSOs on any PSO platform).							
NARW PAM [3] Clearance/Shutdown Zone	10,000 m (pin), 15,000 m (monopile)							
Blue, Fin, Sei Whale Clearance/Shutdown Zone Summer (Winter)	4,000 m (4,100 m)	2,300 m (2,700 m)	4,200 m	400 m	2,300	NAS	4,000 m	3,000 m
Sperm Whales Visual Clearance/Shutdown Zone	NAS							

Sea Turtles Visual Clearance/Shutdown Zone	200 m

(Source Table 54, 89 FR 53708 and additional information provided by NMFS OPR during the consultation period and SouthCoast Wind BA [for sea turtles, as modified during the consultation period])

NAS = noise attenuation system (*e.g.*, double bubble curtain (DBBC)). This zone size designation indicates that the clearance and shutdown zones, based on modeled distances to the Level A harassment thresholds, would not extend beyond the DBBC deployment radius around the pile.

[1] PSOs must be able to visually monitor minimum visibility zones. To provide enhanced protection of North Atlantic right whales during foundation installations in the NARW EMA, SouthCoast proposed monitoring of minimum visibility zones equal to the Level B harassment zones when installing pin piles (4.8 km (3.0 mi)) and monopiles (7.4 km (4.6 mi)). Outside the NARW EMA, the minimum visibility zone would be equal to SouthCoast's clearance/shutdown zones for other baleen whales.

[2]Within the NARW EMA August 1- October 15 and throughout the Lease Area May 16-31 and December 1-31, for any acoustic detection within the North Atlantic right whale PAM clearance and shutdown zones or sighting of 1 or 2 North Atlantic right whales, SouthCoast Wind must delay commencement of or shutdown pile driving for 24 hours. For any sighting of 3 or more North Atlantic right whales, SouthCoast Wind must delay commencement of or shutdown pile driving for 48 hours. Prior to beginning clearance at the pile driving location after these periods, SouthCoast must conduct a vessel-based survey to visually clear the 10-km (6.2-mi) zone, if installing pin piles that day, or 15-km (9.32- mi) zone, if installing monopiles;

[3] The PAM system used during clearance and shutdown must be designed to detect marine mammal vocalizations, maximize baleen whale detections, and must be capable of detecting North Atlantic right whales at 10 km (6.2 mi) and 15 km (9.3 mi) for pin piles and monopile installations, respectively. NMFS recognizes that detectability of each species' vocalizations will vary based on vocalization characteristics (*e.g.*, frequency content, source level), acoustic propagation conditions, and competing noise sources), such that other marine mammal species (*e.g.*, harbor porpoise) may not be detected at 10 km (6.2 mi) or 15 km (9.3 mi).

11.1.b Clearance Zones** during UXO/MEC Detonations in the Export Cable Corridor (ECC) and Wind Farm Area (WFA), by Charge Weight and Assuming 10 dB of Sound Attenuation

UXO/MEC Weight Charge	NARW, Blue, Fin, and Sei Whales		Sperm Whales		Sea Turtles
	ECC	WFA	ECC	WFA	All Sites
PAM Clearance Zone*	15,000 m				N/A
E4 (2.3 kg) Clearance Zone	800 m	400 m	100 m	50 m	500 m
E6 (9.1 kg) Clearance Zone	1,500 m	900 m	200 m	50 m	
E8 (45.5 kg) Clearance Zone	2,900 m	1,900 m	300 m	100 m	
E10 (227 kg) Clearance Zone	4,200 m	3,500 m	500 m	300 m	
E12 (454 kg) Clearance Zone	4,900 m	4,500 m	600 m	400 m	

(Source: Table 55, 89 FR 53708 and updates provided by NMFS OPR during the consultation period)

*The PAM system used during clearance must be designed to detect marine mammal vocalizations, maximize baleen whale detections, and must be capable of detecting North Atlantic right whales at distances up to 15 km (9.3 mi) from the foundation installation site. NMFS recognizes that detectability of each species' vocalizations will vary based on vocalization characteristics (e.g., frequency content, source level), acoustic propagation conditions, and competing noise sources), such that other marine mammal species (e.g., harbor porpoise) may not be detected at 15 km (9.3 mi).

**The clearance zones, which are visually and acoustically monitored, for UXO/MEC detonations were derived based on an approximate proportion of the size of the Level B harassment (TTS) isopleth. The clearance zone sizes are contingent on SouthCoast Wind being able to demonstrate that they can identify charge weights in the field; if they cannot identify the charge weight sizes in the field then SouthCoast would need to assume the E12 charge weight size for all detonations and must implement the E12 clearance zone.

Consideration/Justification for RPMs and Terms and Conditions

As explained above, reasonable and prudent measures are measures to minimize the amount or extent of incidental take (50 C.F.R. §402.02) that must be implemented in order for the incidental take exemption to be effective. The reasonable and prudent measures and terms and conditions are specified as required by 50 CFR 402.14 (i)(1)(ii), (iii) and (iv) to document the incidental take by the proposed action, minimize the impact of that take on ESA-listed species and, in the case of marine mammals, specify those measures that are necessary to comply with section 101(a)(5) of the Marine Mammal Protection Act of 1972 and applicable regulations with regard to such taking. We document our consideration of these requirements for reasonable and prudent measures and terms and conditions here. We have determined that all of these RPMs and associated terms and conditions are reasonable and necessary or appropriate, to minimize or document take and that they all comply with the minor change rule. That is, none of these RPMs or their implementing terms and conditions alter the basic design, location, scope, duration, or timing of the action, and all involve only minor changes.

RPM 1/Term and Condition 1

The proposed ITA includes a number of general conditions and specific mitigation measures that are considered part of the proposed action. The final ITA issued under the MMPA may have modified or additional measures that clarify or enhance the measures identified in the proposed ITA. Compliance with those measures is necessary and appropriate to minimize and document incidental take of North Atlantic right, blue, sperm, sei, and fin whales. As such, the terms and conditions that require BOEM, BSEE, USACE, and NMFS OPR to ensure compliance with the conditions and mitigation measures of the final ITA are necessary and appropriate to minimize the extent of take of these species and to ensure that take is documented. As explained in section 3, we note that the final MMPA ITA may contain measures that include requirements that may differ from the proposed rule; as explained in this Opinion's ITS, compliance with the conditions of the final MMPA ITA is necessary for the ESA take exemption to apply to ESA-listed marine mammals. We therefore consider any measures specified in the proposed MMPA ITA to be mandatory elements of the proposed action while acknowledging that they may be modified or supplemented in the final MMPA ITA. We also note that while the applicant will be separately required by the final MMPA ITA to comply with any such additional measures, this consultation's Effects Analysis and Conclusion do not rely on any such additional measures not already identified here as part of the proposed action (i.e., those measures proposed by SouthCoast Wind, identified in BOEM's BA, or in the MMPA Proposed Rule. We will review the final rule and any modified or additional mitigation measures to determine whether our effects analysis and conclusions may need to be modified.

RPM 1/Term and Condition 2 and 4

The proposed action incorporates requirements for Thorough and Abbreviated sound field verification (SFV) and outlines general measures to be implemented as a result of SFV. Term and Condition 2 is necessary and appropriate to provide clarification of the required steps related to sound field verification and measures to be implemented as a result of sound field verification. Additionally, this measure requires Abbreviated SFV monitoring, using a single hydrophone, during all foundation pile driving where Thorough SFV monitoring is not carried out. This requirement implements one of the recommendations included in BOEM's August 2023 *Recommendations for Offshore Wind Project Pile Driving Sound Exposure Modeling and Sound Field Measurement*[65]. This measure was developed in close coordination with BOEM's Center for Marine Acoustics, BSEE, and NMFS OPR. This measure is necessary and appropriate to monitor take; the exposure estimates and amount and extent of incidental take exempted in this ITS are based on the size of the area that will experience noise above the identified thresholds during pile driving. While the initial, Thorough SFV monitoring, and the associated steps to require any changes to the noise attenuation system, are designed to ensure that pile driving will proceed in a way that is not expected to exceed the modeled distances, there is likely to be variability in pile driving and there may be issues with the sound attenuation systems (e.g., poor bubble curtain performance) that would be undetected without Abbreviated SFV monitoring. We expect that the required Abbreviated SFV will both allow a continuous check on noise levels and the attenuation system which will allow us to monitor take in a way that supplements detections of sea turtles and whales by the PSOs, but also allow for expeditious detection of any issues with the noise attenuation system or unanticipated variations in noise produced during pile driving so that adjustments can be made and SouthCoast can avoid exceeding the amount and extent of take exempted herein. Additionally, we have determined in this Opinion that take of Atlantic sturgeon as a result of exposure to pile driving noise is not expected and no take has been exempted; because PSOs cannot see sturgeon, this Abbreviated SFV monitoring will allow for monitoring of noise levels to compare to the modeled distances to the injury and behavioral disturbance thresholds for sturgeon and ensure that these distances are not exceeded. Term and Condition 4 is necessary and appropriate to require the implementation of maintenance of the noise attenuation system; this is expected to be necessary to ensure proper function, which is necessary to achieve the required attenuation. Reporting of SFV results are addressed through Term and Condition 6.

RPM 2 /Term and Condition 3 and 4

During the consultation period, the clearance zones for sea turtles during pile driving and UXO detonation were revised by BOEM. The measure included in Term and Condition 3 clarifies the size of the clearance zone during all UXO detonations, regardless of charge size, as 500 m. The size of the clearance zone minimizes the risk that a sea turtle just outside the clearance zone would enter the area where noise would be above the PTS threshold before the detonation occurred. Given the extensive PSO coverage, that will be required during UXO detonations, and the requirement that detonation can occur during daylight only when visibility is excellent, we expect that this larger area will be able to be effectively monitored. Implementation of this measure will serve to minimize take. Term and Condition 3 requires NMFS to be notified 48-hours in advance of any planned detonation. This notification will allow us to alert NMFS sea turtle and marine mammal stranding network partners, consistent with best practices, who can then be on alert for any reports of injured or distressed animals, which will assist in monitoring the effects of the detonations. This measure includes a clause for reduced notification period if a 48-hour delay would result in imminent risk of human life or safety. Term and Condition 3 is

[65] https://www.boem.gov/sites/default/files/documents/renewable-energy/BOEMOffshoreWindPileDrivingSoundModelingGuidance.pdf; last accessed December October 23, 2024.

necessary and appropriate to provide clarification of the required steps related to sound field verification and measures to be implemented as a result of sound field verification. Term and Condition 4 is necessary and appropriate to require the implementation of maintenance of the noise attenuation system; this is expected to be necessary to ensure proper function, which is necessary to achieve the required attenuation.

RPM 3/Term and Condition 5

RPM 3 is necessary and appropriate to monitor the amount of take of North Atlantic right whales, by harassment, which we have determined is reasonably certain to occur. As explained above, we have not identified any RPMs or Terms and Conditions that could minimize or offset this take. Monitoring of reduced feeding efficiency and subsequent energetic costs in right whales is not considered feasible at this time. As such, as explained above we have identified a reinitiation trigger and associated monitoring measure. We will consider that the amount of incidental take has been exceeded if monitoring, carried out consistent with an approved monitoring plan, demonstrates that in a given year (considering seasonal and other variation), the extent of hydrodynamic wakes exceeds 1,800 m at any foundation and exceeds an average of 1,000 m across all foundations monitored. We consider that this would indicate that the geographic extent of the area where foraging would be disrupted is bigger than we anticipated, which indicates that either a greater number of right whales would experience effects that met the interim definition of harassment or that the extent of the disruptions were greater than anticipated. The RPM and implementing Term and Condition below is designed to monitor the effects of the action and provide a means for determining if take has been exceeded. The RPM and Term and Condition is necessary and appropriate so that the amount and extent of take of right whales can be evaluated.

RPM 4/Term and Conditions 6, 7, 8, and 11

Documenting the effects of project activities and any take that occurs is essential to ensure that reinitiation of consultation occurs if the amount or extent of take identified in the ITS is exceeded. Some measures for documenting and reporting take are included in the proposed action. The requirements of Term and Conditions 6, 7, 8, and 11 enhance or clarify those requirements. Reporting of SFV results is necessary to monitor the effects of foundation installation and UXO detonation. Documentation and timely reporting of observations of whales, sea turtles, and Atlantic sturgeon is important to monitoring the amount or extent of actual take compared to the amount or extent of take exempted. The reporting requirements included here will allow us to track the progress of the action and associated take. Proper identification and handling of any sturgeon and sea turtles that are captured in the survey gear is essential for documenting take and to minimize the extent of that take (i.e., reducing the potential for further stress, injury, or mortality). The measures identified here are consistent with established best practices for proper handling and documentation of these species. Identifying existing tags helps to monitor take by identifying individual animals. Requiring genetic samples (fin clips) from all Atlantic sturgeon and that those samples be analyzed to determine the DPS of origin is essential for monitoring actual take as genetic analysis is the only way to identify the DPS of origin for subadult and adult Atlantic sturgeon captured in the ocean. Taking fin clips is not expected to increase stress or result in any injury of Atlantic sturgeon; effects of taking the fin clips are consistent with the effects of the fisheries surveys addressed in this Opinion (i.e., harassment and minor, recoverable injury). The requirements for observer qualifications in Term and Condition 11 are necessary and appropriate to ensure that handling and documentation of sturgeon and turtles collected in the trawl survey is done by appropriately trained personnel, which will minimize the extent of take by reducing the risk of unintentional stress or injury that could result from inappropriate or extended handling of captured individuals.

RPM 4/Term and Condition 9

We recognize that documenting sea turtles that were struck by project vessels may be difficult given their small size and the factors that contribute to cryptic mortality addressed in the *Effects of the Action* section of this Opinion. Therefore, we are requiring that BOEM, BSEE, and SouthCoast document any and all observations of dead or injured sea turtles over the course of the project and that a report be prepared annually to facilitate the review of the best available information and determine which, if any, of those sea turtles have a cause of death that is attributable to project operations. We expect that we will consider the factors reported with the particular turtle (i.e., did the lookout suspect the vessel struck the turtle), the state of decomposition, any observable injuries, and the extent to which project vessel traffic contributed to overall traffic in the area at the time of detection.

RPM 5/Term and Condition 10

Term and Condition 10 requires BOEM, BSEE, and/or USACE to provide updates on certain project information (listed in the condition) to us following BSEE's review of the Facility Design Report (FDR) and/or Fabrication and Installation Report or whenever the identified information is available. Because SouthCoast used a project design envelope for environmental permitting, a number of the project parameters have not been finalized. Receipt of this information from BOEM, BSEE, or USACE is necessary for us to ensure that the project to be constructed is consistent with the description of the proposed action in the Opinion and allows us an opportunity to identify if any changes to the ITS would be appropriate. For example, if the project described in the FDR includes significantly fewer pile driven WTG foundations than described in the Opinion, adjustments to the amount of exempted take may be appropriate. Requiring the submission of information on how the project will be implemented is necessary and appropriate to allow us to determine if the amount or extent of take is likely to be exceeded (or alternatively, if it would be an overestimate), and allows for us to accurately monitor the proposed action and associated incidental take.

RPM 5/Term and Condition 12

A number of plans are proposed for development and submission by SouthCoast and/or required for submission by BOEM, BSEE, or NMFS OPR. Term and Condition 12 identifies all of the plans that must be submitted to NMFS GARFO, identifies timeline for submission, and clarifies any relevant requirements. This will minimize confusion over submission of plans and facilitate efficient review of the plans. Implementation of these plans will minimize or monitor take, dependent on the plan. Obtaining NMFS concurrence with these plans prior to implementation of the associated activity is necessary and appropriate to ensure that the activities are carried out in a way that is consistent with the proposed action described herein, including compliance with the avoidance, minimization, or monitoring measures built into the proposed action, or to ensure that the measures outlined in this ITS are implemented as intended. Preparation, review, and concurrence with these plans is necessary because the relevant details were not available at the time this consultation was initiated or completed.

RPM 6/Term and Condition 13-15
RPM 6 and its associated terms and conditions are reasonable and necessary or appropriate to minimize and monitor incidental take. Measures to minimize and monitor incidental take, whether part of the proposed action or this ITS, first must be implemented in order to achieve the beneficial results anticipated in this Opinion for ESA listed species. The action agencies exercising their authorities to assess and ensure compliance with the measures to avoid, minimize, monitor, and report incidental take of ESA listed species, including the measures that were incorporated into the description of the proposed action is an essential component of ensuring that incidental take is minimized and monitored. Likewise, such measures once implemented must be effective at minimizing and monitoring incidental take consistent with the analysis. While the measures described as part of the proposed action and in the ITS are consistent with best practices in other industries, and are anticipated to be practicable and functional, gathering information in situ through observation, inspection, and assessment may confirm expectations or reveal room for improvement in a measure's design or performance, or in SouthCoast's implementation and compliance. While the ITS states that action agencies must adopt the RPMs and terms and conditions as enforceable conditions in their own actions, and while each agency is responsible for oversight regarding its own actions taken, specifying that SouthCoast must consent to NOAA (or other enforcement related) personnel's attendance during offshore wind activities clarifies its role as well. Given the nascence of the U.S. offshore wind industry, information gathering on the implementation and effectiveness of these measures will help ensure that effects to listed species and their habitat are minimized and monitored. Term and Condition 15 requires prompt notification of any non-compliance with measures that are designed to avoid, minimize, or monitor effects to ESA listed species; this is necessary not only to monitor incidental take and the implementation of this ITS but also to ensure that appropriate corrective actions are taken. This will also facilitate identification of any need to reinitiate this consultation.

12.0 CONSERVATION RECOMMENDATIONS

In addition to Section 7(a)(2), which requires agencies to ensure that all projects will not jeopardize the continued existence of listed species, Section 7(a)(1) of the ESA places a responsibility on all federal agencies to "utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species." Conservation Recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information in furtherance of these identified purposes. As such, NMFS recommends that the BOEM, BSEE, USACE, and the other action agencies implement the following Conservation Recommendations consistent with their authorities:

1. Work with the lessee to identify opportunities to further reduce pile driving and UXO/MEC detonations in May, November, and December, which could further reduce potential exposure of North Atlantic right whales and other protected species to noise from these sources. This could include applying the pile driving time of year restrictions for the NARW EMA to UXO/MEC detonations in those areas.

2. Collect data to add to the limited information we have on underwater noise generated during operations of the project's wind turbines.
    i. A study to document operational noise of WTGs during a variety of wind and weather conditions should be carried out. This should complement the operational noise monitoring required by conditions of the proposed MMPA ITA.

3. Support research and development of technology to aid in the minimization of risk of vessel strikes on marine mammals, sea turtles, and Atlantic sturgeon.

4. Support development of regional monitoring of project and cumulative effects through the Regional Wildlife Science Collaborative for Offshore Wind (RWSC).

5. Work with the NEFSC to support robust monitoring and study design with adequate sample sizes, appropriate spatial and temporal coverage, and proper design allowing the detection of potential impacts of offshore wind projects on a wide range of ecological and oceanographic conditions including protected species distribution, prey distribution, pelagic habitat, and habitat usage.

6. Support research into furthering understanding the effects of offshore wind development on regional oceanic and atmospheric conditions through modeling and data collection, and assessment of potential impacts on protected species, their habitats, and distribution of zooplankton and other prey.

7. Support the continuation of aerial surveys for post-construction monitoring of listed species in the SouthCoast WFA and surrounding waters, and methods for survey adaptation to the presence of wind turbines.

8. Support research on construction and operational impacts to protected species distribution, particularly the North Atlantic right whale and other listed whales. Conduct monitoring pre/during/post construction, including long-term monitoring during the operational phase, including sound sources associated with turbine maintenance (e.g., service vessels), to understand any changes in protected species distribution and habitat use in the southern New England region.

9. Support the deployment of acoustic tags on sea turtles and sturgeon and the continued maintenance of the receiver array in the SouthCoast WDA.

10. Support research regarding the abundance and distribution of Atlantic sturgeon in the SouthCoast WDA and surrounding region in order to understand the distribution and habitat use and aid in density modeling efforts, including the continued use of acoustic telemetry networks to monitor for tagged fish.

11. Require the lessee to send all acoustic telemetry metadata and detections to the Mid-Atlantic Acoustic Telemetry Observation System (MATOS) database via www.matos.asascience.com for coordinated tracking of marine species over broader spatial scales in US Animal Tracking Network and Ocean Tracking Network.

12. Conduct or support long-term ecological monitoring to document the changes to the ecological communities on, around, and between foundations and other benthic areas disturbed by the proposed Project.

13. Develop or support the development of a PAM array in the SouthCoast WDA to monitor changes in ambient noise and use of the area by baleen whales (and other marine mammals) during the life of the Project, including construction, and to detect small-scale changes at the scale of the SouthCoast WDA. Bottom-mounted recorders should be deployed at a maximum of 20 km distance from each other throughout the given study area in order to ensure near to complete coverage of the area over which North Atlantic right whales and other baleen whales can be heard. See Van Parijs et al. 2021 for specific details. The lessee is encouraged to follow the RWSC PAM best practices (https://rwscollab.github.io/pam-data-mgmt/), submit data products to Passive Acoustic Cetacean Map (https://www.fisheries.noaa.gov/resource/document/passive-acoustic-reporting-system-templates) via the https://www.fisheries.noaa.gov/resource/document/passive-acoustic-reporting-system-templates, and archive raw acoustic data at National Center for Environmental Information (https://www.ncei.noaa.gov/products/passive-acoustic-data).

14. Support the development of a regional PAM network across lease areas to monitor long-term changes in baleen whale distribution and habitat use. A regional PAM network should consider adequate array/hydrophone design, equipment, and data evaluation to understand changes over the spatial scales that are relevant to these species for the duration of these projects, as well as the storage and dissemination of these data.

15. Monitor changes in commercial fishing activity to detect changes in bycatch or entanglement rates of protected species, particularly the North Atlantic right whale, and support the adaptation of ropeless fishing practices where necessary. Conduct regular surveys and removal of marine debris from project infrastructure, including conducting work in conjunction with groups who have experience conducting such clean ups.

16. Provide support to groups that participate in regional stranding networks, which supports data collection on listed species in the region. See https://www.fisheries.noaa.gov/report for a list of regional network organizations.

17. BOEM and NMFS OPR should work to make the data collected as part of the required monitoring and reporting available to the public and scientific community in an easily accessible online database that can be queried to aggregate data across PSO reports. Access to such data, which may include sightings as well as responses to project activities, will not only help us understand the biology of ESA listed species (e.g., their range), it will inform future consultations and incidental take authorizations/permits by providing information on the effectiveness of the conservation measures and the impact of offshore wind activities on ESA listed species and/or designated critical habitat.

18. BOEM should require that SouthCoast vessels operating in the Gulf of Mexico comply with measures consistent with those in BOEM NTL No. 2023-G01 (https://www.boem.gov/sites/default/files/documents/about-boem/regulations-guidance/BOEM%20NTL%202023-G01.pdf) and any future updates. Additionally, if a Rice's whale (and any other whales that may be Rice's whales) is observed at any time by PSOs or project personnel, the sighting should be reported to NMFS-SERO by calling 1-877-WHALE-HELP. If calling the hotline is not possible, sighting reports should be submitted to nmfs.ser.rw.sightings@noaa.gov. The sighting report should include the time, date, and location (latitude/longitude) of the sighting, number of whales, animal description/certainty of sighting (provide photos/video if taken), lease area/project name, PSO/personnel name, PSO provider company (if applicable), and contact info.

13.0 REINITIATION NOTICE

This concludes formal consultation for the proposed authorizations listed herein for the SouthCoast Wind offshore wind energy project. As 50 C.F.R. §402.16 states, reinitiation of formal consultation is required and shall be requested by the Federal action agency where discretionary Federal involvement or control over the action has been retained or is authorized by law and:

(1) If the amount or extent of taking specified in the incidental take statement is exceeded;

(2) If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered;

(3) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion or written concurrence; or,

(4) If a new species is listed or critical habitat designated that may be affected by the identified action.

14.0 LITERATURE CITED

16 USC § 1802(16). Merchant Marine Act and Magnuson-Stevens Act Provisions; Fishing Vessel, Fishing Facility and Individual Fishing Quota and Harvest Rights Lending Program Regulations. October 31, 2017.

30 C.F.R. 250.913. Oil and Gas and Sulphur Operations in the Outer Continental Shelf; When to resubmit platform verification program plans. July 1, 2020.

30 CFR 285.700(a)-(c). What reports must I submit to BSEE before installing facilities described in my approved SAP, COP, or GAP?

30 CFR 285.910(a). Reorganizations of Title 30-Renewable Energy and Alternate Uses of Existing Facilities on the Outer Continental Shelf. January 31, 2023.

30 CFR 585.910. Renewable Energy on the Outer Continental Shelf - Removal. January 31, 2023.

33 CFR §151.2025. Vessel Incidental Discharge National Standards of Performance. October 26, 2020.

33 CFR Part 66. Private Aids to Navigation. September 18, 2020.

33 CFR Part 67. Aids to Navigation on Artificial Islands and Fixed Structures. May 5, 2004.

33 U.S.C. 403 - Obstruction of navigable waters generally; wharves; piers, etc.; excavations and filling in. January 3, 2024.

40 CFR § 423.11(a). Specialized Definitions. October 13, 2020.

40 CFR 1508.1(i)(3). Definitions. July 16, 2020.

50 CFR 216. Regulations Governing the Taking and Importing of Marine Mammals. January 15, 1974.

50 C.F.R. §222.102. Definitions. March 23, 1999.

50 CFR 224.105. Speed Restrictions to Protect North Atlantic Right Whales. March 23, 1999.

50 CFR 402.02. Interagency Cooperation - Endangered Species Act of 1973, As Amended. Definitions. August 27, 2019.

50 CFR 402.14 (i)(1) & (2) Interagency Cooperation - Endangered Species Act of 1973, As Amended. Formal Consultation. Incidental Take. August 27, 2019.

50 CFR 402.16. Reinitiation Consultation - Endangered Species Act of 1973, As Amended. Formal Consultation. August 27, 2019.

50 CFR 402.17 Interagency Cooperation - Endangered Species Act of 1973, As Amended. Other provisions. August 27, 2019.

50 CFR §600.745(a). Magnuson-Stevens Act Provisions - Scientific Research Activity, Exempted Fishing, and Exempted Educational Activity. June 24, 1996.

42 USC § 4321 et seq. The Public Health and Welfare National Environmental Policy. January 1, 1970.

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APPENDIX A.

Measures Included in BOEM's BA that are Part of the Proposed Action for the SouthCoast Wind ESA Consultation

Number	Measure	Applicant Proposed Measures as may be Modified in the Final LOA under the MMPA	BOEM Proposed Measures	Project Phase
1	Compliance with LOA		The measures required by the final MMPA LOA for Incidental Take Regulations will be incorporated into COP approval and Record of Decision conditions, and BOEM and/or BSEE will monitor compliance with these measures. BOEM will require the applicant comply with all the conditions herein when not superseded by an active LOA/IHA.	C
2	Cooling System Prohibition in Enhanced Mitigation Area		To minimize potential impacts onto zooplankton from impingement and entrainment in offshore wind HVDC converter station once-through (open-loop) cooling systems, no open-loop cooling systems will be permitted within the enhanced mitigation area (Figure 3.3-1) of the Lease Area. No geographic restrictions on the offshore export cable corridor, nor the installation of an HVAC OSP are included in this mitigation measure.	O&M
3	Protected Species Observer (PSO) and Acoustic Protected Species Observer (APSO) Experience and Responsi-bilities during Pile Driving and UXO/MEC Detonation	See Appendix B Protected Species Observers (PSO), Acoustic Protected Species Observers (APSO), and Passive Acoustic Monitoring (PAM) operators will have met NMFS and BOEM training and experience requirements. PSOs and APSOs will be employed by a third-party observer provider. Briefings between construction supervisors and crews and the PSO/APSO team will be held prior to the start of all pile driving activities as well as when new personnel join the vessel(s). The PSO team and the APSO team will each have a lead observer (Lead PSO and Lead APSO) who will be unconditionally approved by NMFS and have a minimum of 90 days at-sea experience in a northwestern Atlantic Ocean environment performing the visual (Lead PSO) or acoustic role (Lead APSO), with the conclusion of the most recent relevant experience no more than 18 months previous. APSOs responsible for determining if an acoustic detection originated from a NARW will be trained in identification of mysticete vocalizations. PSOs will have no other responsibilities while on watch. Lead PSOs carry the same duties as PSOs and also	The Lessee must use PSOs provided by a third party. PSOs must have no Project-related tasks other than to observe, collect and report data, and communicate with and instruct relevant vessel crew regarding the presence of protected species and mitigation requirements (including brief alerts regarding maritime hazards). PSOs or any PAM operators serving as PSOs must have completed a commercial PSO training program for the Atlantic with an overall examination score of 80 percent or greater. The Lessee must provide training certificates for individual PSOs to BOEM upon request. And PSOs and PAM operators must be approved by NMFS before the start of a survey. Application requirements to become a NMFS-approved PSO for construction activities can be found online or for geological and geophysical surveys by sending an inquiry to nmfs.psoreview@noaa.gov. Specific PSO Requirements include: 1. At least one PSO must be on duty at all times as the lead PSO or as the PSO monitoring coordinator during pile driving. Total PSO coverage must be adequate to ensure effective monitoring to reliably detect whales and sea turtles in the identified clearance and shutdown zones and execute any pile driving delays or shutdown requirements. 2. At least one lead PSO must be present on each vessel during pile driving activities. PSOs on transit vessels must be approved by NMFS but need not be authorized as a lead PSO. Lead PSOs must have prior approval from NMFS as an unconditionally approved PSO. 3. All PSOs on duty must be clearly listed and the lead PSO identified on daily data logs for each shift. 4. A sufficient number of PSOs, consistent with the Biological Opinion and as	C

		manage the activities associated with the PSO team, PAM team, and SFV team. Any PSO or APSO on duty will have the authority to delay the start of operations or to call for a shutdown based on their observations or acoustic detection. Lead APSOs will be able to troubleshoot the acoustic equipment and assist in making final decisions regarding species identifications, localization, and other acoustic monitoring details that will be relayed to the Lead PSO. A clear line and method of communication between the PSOs/APSOs and pile driving crew will be established and maintained to ensure mitigation measures are conveyed without delay.	prescribed in the final Incidental Take Authorization (ITA), must be deployed to record data in real time and effectively monitor the required clearance, shutdown, or monitoring zone for the Project. 5. The duties of these PSOs include visual surveys in all directions around a pile; PAM; and continuous monitoring of sighted NARWs. 6. Where applicable, the number of PSOs deployed must meet the NARW enhanced seasonal monitoring requirements. 7. A PSO must not be on watch for more than 4 consecutive hours and must be granted a break of no fewer than 2 hours after a 4-hour watch.	
4	Visual Monitoring	Measures described fully in the SouthCoast Wind Incidental Take Regulations (ITR) Application, March 2024 (LGL 2024) include visual monitoring procedures, equipment, and break periods. Includes specifics on observations during project activities as well as monitoring at night or in low visibility conditions. SouthCoast Wind is exploring opportunities in coordination with NOAA, to use currently available technologies to conduct monitoring using PSOs and APSOs who may be stationed in locations other than offshore vessels (e.g., onshore); however, this does not exempt onsite PSO requirements for each platform (e.g., PSOs onboard the pile driving vessel, detonation vessel, or HRG survey vessel). The following types of equipment will be used to monitor for marine mammals from one or more locations: · Reticle binoculars · Mounted thermal/IR camera system. The camera systems may be automated with detection alerts that will be checked by a PSO on duty; however, cameras may not be manned by a dedicated observer. · Mounted "big-eye" binocular · Hand-held or wearable NVDs · IR spotlights · Data collection software system · PSO-dedicated VHF radios · Digital single-lens reflex camera equipped with 11.8 inch (300 millimeter) lens.		C

5	Protected Species Training	SouthCoast Wind must comply with vessel strike avoidance measures while in the geographic region specified in the LOA unless a deviation is necessary to maintain safe maneuvering speed and justified because the vessel is in an area where oceanographic, hydrographic, and/or meteorological conditions severely restrict the maneuverability of the vessel; an emergency situation presents a threat to the health, safety, life of a person; or when a vessel is actively engaged in emergency rescue or response duties, including vessel-in distress or environmental crisis response. An emergency is defined as a serious event that occurs without warning and requires immediate action to avert, control, or remedy harm. Speed over ground will be used to measure all vessel speeds:	The Lessee must provide Project-specific training to all vessel crew members, Visual Observers, and Trained Lookouts on the identification of sea turtles and marine mammals, vessel strike avoidance and reporting protocols, and the associated regulations for avoiding vessel collisions with protected species. Reference materials for identifying sea turtles and marine mammals must be available aboard all Project vessels. Confirmation of the training and understanding of the requirements must be documented on a training course log sheet, and the Lessee must provide the log sheets to DOI upon request. The Lessee must communicate to all crew members its expectation for them to report sightings of sea turtles and marine mammals to the designated vessel contacts. The Lessee must communicate the process for reporting sea turtles and marine mammals (including live, entangled, and dead individuals) to the designated vessel contact and all crew members. The Lessee must post the reporting instructions including communication channels in highly visible locations aboard all Project vessels. All vessel crew members must be briefed on the identification of sea turtles and on regulations and best practices for avoiding vessel collisions. Reference materials must be available aboard all project vessels for identification of sea turtles. The expectation and process for reporting of sea turtles (including live, entangled, and dead individuals) must be clearly communicated and posted in highly visible locations aboard all project vessels, so that there is an expectation for reporting to the designated vessel contact (such as the lookout or the vessel captain), as well as a communication channel and process for crew members to so report.	C, O&M, D
6	Vessel Strike Avoidance – Safety Exemption	See Appendix B SouthCoast Wind must comply with vessel strike avoidance measures while in the geographic region specified in the LOA unless a deviation is necessary to maintain safe maneuvering speed and justified because the vessel is in an area where oceanographic, hydrographic, and/or meteorological conditions severely restrict the maneuverability of the vessel; an emergency situation presents a threat to the health, safety, life of a person; or when a vessel is actively engaged in emergency rescue or response duties, including vessel-in distress or environmental crisis response. An emergency is defined as a serious event that occurs without warning and requires immediate action to avert, control, or remedy harm. Speed over ground will be used to measure all vessel speeds:		C
7	Vessel Strike Avoidance - Plan	See Appendix B. In addition the lessee must implement the following; Vessels will comply with mandatory measures stipulated in the NOAA NARW Vessel Strike Reduction Regulations. All vessels, regardless of size, will transit at ≤10 kts within any active NARW SMAs and Slow Zone (i.e., DMAs or acoustically-		C, O&M, D

		triggered Slow Zones). During migratory and calving periods from November 1 to April 30, all project vessels will operate at ≤10 knots when in the Project Area. All vessel speeds will be reduced to ≤10 kts when mother/calf pairs, pods, or large assemblages of marine mammals are observed. SouthCoast Wind will implement (or participate in a joint program, if developed) a PAM system designed to detect NARW within the transit corridor and additional visual monitoring measures as described fully in SouthCoast Wind's ITR. A Vessel Strike Avoidance Plan that provides a more detailed description of the equipment and methods to conduct the monitoring summarized below will be provided to NMFS at least 90-days prior to commencement of vessel movements associated with the activities covered by the ITR. **Acoustic Monitoring:** · A PAM system consisting of near real-time bottom mounted and/or mobile acoustic monitoring systems will be installed such that NARW and other large whale calls made in or near the corridor can be detected and transmitted to the transiting vessel (either directly or through an operations base). · The detections will be used to determine areas along the transit corridor where vessels would be allowed to travel at >10 knots when no other speed restrictions are in place (e.g., 10-knot speed restriction in SMAs and DMAs). · Any detection of a large whale (including NARW) via the PAM system within the transit corridor will trigger a ≤10-knot speed restriction for all Project vessels until the whale can be confirmed visually beyond 500 m of the vessel or 24 hours following the detection and any re- detection has passed. · If the PAM system temporarily stops working, all vessels, regardless of size, will transit at <10 knots in all SMAs (applicable November 1 to April 30) and DMAs (any time of year). Between May 1 and October 31, all vessels regardless of size, will transit at > 10 knots and implement visual monitoring measures with dedicated observers as described above. Measures specify that all data will be recorded based on standard PSO collection requirements using industry-standard software. Data recorded will include information related to ongoing operations, observation methods and effort, visibility conditions, marine mammal detections, and any mitigation actions requested and enacted. Measures define specific marine mammal observations and situations (e.g., observations of dead, stranded, entangled, or		

		injured animals) that would require reporting to NMFS. Measures specify protocols for submission of data and final reports to NMFS and BOEM. Measures define specific marine mammal observations and situations (e.g., observations of dead, stranded, entangled, or injured animals) that would require reporting to NMFS.		
8	Vessel Strike Avoidance – Visual Monitoring and Communi-cation	See Appendix B	The Lessee must ensure that vessel operators and crew members maintain a vigilant watch for marine mammals and sea turtles, and reduce vessel speed, alter the vessel's course, or stop the vessel as necessary to avoid striking marine mammals or sea turtles. All vessels transiting from ports outside the United States will be required to have a trained lookout on board who will start monitoring for the presence of NARWs and other protected species when the vessel enters U.S. waters, during which the trained lookout must monitor a vessel strike avoidance zone around the vessel. The trained lookout must maintain a vigilant watch at all times a vessel is underway, and when technically feasible, be capable of monitoring the 500-meter Vessel Strike Avoidance Zone for ESA-listed species and to maintain minimum separation distances. Alternative monitoring technology (e.g., night vision, thermal cameras) must be available to maintain a vigilant watch at night and in any other low visibility conditions. If a vessel is carrying a trained lookout for the purposes of maintaining watch for NARWs, a trained lookout for sea turtles is not required, provided that the trained lookout maintains watch for marine mammals and sea turtles. If the trained lookout is a vessel crew member, the lookout obligations, as noted above, must be that person's designated role and primary responsibility while the vessel is transiting. Vessel personnel must be provided an Atlantic reference guide to help identify marine mammals and sea turtles that may be encountered. Vessel personnel must also be provided material regarding NARW Seasonal Management Areas (SMAs), Dynamic Management Areas (DMAs), and Slow Zones, sightings information, and reporting. All observations must be recorded per reporting requirements. Outside of active watch duty, members of the monitoring team must check NMFS Right Whale Sighting Advisory System (RWSAS) for the presence of NARWs in the SouthCoast Wind farm and along the routes vessels are transiting. The trained lookout must check https://seaturtlesightings.org before each trip and report any detections of sea turtles in the vicinity of the planned transit to all vessel operators or captains and lookouts on duty that day. For all vessels operating north of the Virginia/North Carolina border, between June 1 and November 30, the Lessee must have a trained lookout posted on all vessel transits during all phases of the Project to observe for sea turtles. For all vessels operating south of the Virginia/North Carolina border, year-round, the Lessee must have a trained lookout posted on all vessel transits during all phases of the Project to observe for sea turtles. The trained lookout	C, O&M, D

			will communicate any sightings in real time to the captain to implement required avoidance measures. The Lessee must ensure that whenever multiple Project vessels are operating, any visual detections of ESA-listed species (marine mammals and sea turtles) are communicated in near real time to a third-party Protected Species Observer (PSO), vessel captains, or both associated with other Project vessels. All vessel operators must check for information regarding mandatory or voluntary ship strike avoidance and daily information regarding NARW sighting locations. These media may include, but are not limited to: NOAA weather radio, U.S. Coast Guard NAVTEX and Channel 16 broadcasts, Notices to Mariners, the Whale Alert app, or WhaleMap website. Information about active SMAs and Slow Zones can be accessed at: https://www.fisheries.noaa.gov/national/endangered-species-conservation/reducing-vessel- strikes-north-atlantic-right-whales	
9	Vessel Strike Avoidance – Separation Distances and Course Changes		If an ESA-listed whale or large unidentified whale is identified within 1, 640 feet (500 meters) of the forward path of any vessel (90 degrees port to 90 degrees starboard), the vessel operator must immediately implement strike avoidance measures and steer a course away from the whale at 10 knots (18.5 kilometers per hour) or less until the vessel reaches a 1,640-feet (500 meter) separation distance from the whale. Trained lookouts, visual observers, vessel crew, or PSOs must notify the vessel captain of any whale observed or detected within 1,640 feet (500 meters) of the Project vessel. Upon notification, the vessel captain must immediately implement vessel strike avoidance procedures to maintain a separation distance of 1,640 feet (500 meters) or reduce vessel speed to allow the animal to travel away from the vessel. If a whale is observed but cannot be confirmed as a species other than a NARW, the vessel operator must assume that it is a NARW and execute the required vessel strike avoidance measures to avoid the animal. If an ESA-listed large whale is sighted within 656 feet (200 meters) of the forward path of a vessel, the vessel operator must initiate a full stop by reducing speed and shift the engine to neutral. Engines must not be engaged until the whale has moved outside of the vessel's path and beyond 1,640 feet (500 meters). If stationary, the vessel must not engage engines until the ESA- listed large whale has moved beyond 1,640 feet (500 meters). If pinnipeds or small delphinids of the genera Delphinus, Lagenorhynchus, Stenella, or Tursiops are visually detected approaching the vessel (i.e., to bow ride) or towed equipment, vessel speed reduction, course alteration, and shutdown are not required. For small cetaceans and seals, all vessels must maintain a minimum separation distance of 164 feet (50 meters) to the maximum extent practicable, except when those animals voluntarily approach the vessel. When marine mammals are sighted while a vessel is underway, the vessel operator must endeavor to avoid violating the 164-foot (50-meter) separation distance by attempting to remain parallel to the animal's course and avoiding excessive speed or abrupt changes in vessel direction until the animal has left the area, except when taking such measures would threaten	C, O&M, D

			the safety of the vessel or crew. If marine mammals are sighted within the 164- foot separation distance, the vessel operator must reduce vessel speed and shift the engine to neutral, not engaging the engines until animals are beyond 164 feet (50 meters) from the vessel. The Lessee must slow down to 4 knots if a sea turtle is sighted within 328 feet (100 meters) of the operating vessel's forward path. The vessel operator must then proceed away from the turtle at a speed of 4 knots or less until there is a separation distance of at least 328 feet (100 meters) at which time the vessel may resume normal operations. If a sea turtle is sighted within 164 feet (50 meters) of the forward path of the operating vessel, the vessel operator must shift to neutral when safe to do so and then proceed away from the individual at a speed of 4 knots or less until there is a separation distance of at least 328 feet (100 meters), at which time normal vessel operations may be resumed. Between June 1 and November 30, all vessels must avoid transiting through areas of visible jellyfish aggregations or floating vegetation (e.g., Sargassum lines or mats). In the event that operational safety prevents avoidance of such areas, vessels must slow to 4 knots while transiting through such areas.	
10	Vessel Strike Avoidance – Speed Limits	See Appendix B and Measure 7 (above).	Vessel captain and crew must maintain a vigilant watch for all protected species and slow down, stop their vessel, or alter course, as appropriate and regardless of vessel size, to avoid striking any listed species. The presence of a single individual at the surface may indicate the presence of submerged animals in the vicinity; therefore, precautionary measures must always be exercised upon the sighting of a single individual. Vessels underway must not divert their course to approach any protected species. During construction, vessels of all sizes will operate port to port at 10 knots or less between November 1 and April 30 and while operating in the Lease Area, along the export cable route, or transit area to and from ports. Regardless of vessel size, vessel operators must reduce vessel speed to 10 knots (11.5 mph) or less while operating in any Seasonal Management Area (SMA) or visually- and acoustically-triggered Slow Zones. This requirement does not apply when necessary for the safety of the vessel or crew. Any such events must be reported (see reporting requirements). Otherwise, these speed limits do not apply in areas of Narragansett Bay or Long Island Sound where the presence of NARWs is not expected. The Lessee may only request a waiver from any visually triggered Slow Zone/DMA vessel speed reduction requirements during operations and maintenance, by submitting a vessel strike risk reduction plan that details revised measures and an analysis demonstrating that the measure(s) will provide a level of risk reduction at least equivalent to the vessel speed reduction measure(s) proposed for replacement. The plan included with the request must be provided to NMFS Greater Atlantic Regional Fisheries Office, Protected Resources Division and BOEM at least 90 days prior to the date scheduled for the activities for the waiver is requested. The plan	C, O&M, D

			must not be implemented unless NMFS and BOEM reach consensus on the appropriateness of the plan. BOEM encourages increased vigilance through voluntary implementation of best management practices to minimize vessel interactions with NARWs, and by voluntarily reducing speeds to 10 knots or less when operating within an acoustically triggered slow zone, and when feasible, avoid Slow Zones.	
11	Protected Species Reporting	Measures define specific marine mammal observations and situations (e.g., observations of dead, stranded, entangled, or injured animals) that would require reporting to NMFS. Measures specify protocols for submission of data and final reports to NMFS and BOEM.	The Lessee must immediately report all NARWs observed at any time by PSOs or vessel personnel on any Project vessels, during any Project- related activity, or during vessel transit. Reports must be sent to: BOEM (at renewable_reporting@boem.gov) and BSEE (at protectedspecies@bsee.gov); the NOAA Fisheries 24-hour Stranding Hotline number (866-755- 6622); the Coast Guard (via Channel 16); and WhaleAlert (through the WhaleAlert app at http://www.whalealert.org/). The report must include the time, location, and number of animals. The Lessee is responsible for reporting dead or injured protected species, regardless of whether they were observed during operations or due to Project activities. The Lessee must report any potential take, strikes, dead, or injured protected species caused by Project vessels or sighting of an injured or dead marine mammal or sea turtle, regardless of the cause, to the NMFS Greater Atlantic Regional Fisheries Office, Protected Resources Division (at nmfs.gar.incidental- take@noaa.gov), NOAA Fisheries 24-hour Stranding Hotline number (866-755-6622), BOEM (at renewable_reporting@boem.gov), and BSEE (at protectedspecies@bsee.gov). Reporting must be as soon as practicable but no later than 24 hours from the time the incident took place (Detected or Impacted Protected Species Report). Staff responding to the hotline call will provide any instructions for the handling or disposing of any injured or dead protected species by individuals authorized to collect, possess, and transport sea turtles. Reports must include at a minimum: (1) survey name and applicable information (e.g., vessel name, station number); (2) GPS coordinates describing the location of the interaction (in decimal degrees); (3) gear type involved (e.g., bottom trawl, gillnet, longline); (4) soak time, gear configuration and any other pertinent gear information; (5) time and date of the interaction; and (6) identification of the animal to the species level. Additionally, the e-mail will transmit a copy of the NMFS Take Report Form and a link to or acknowledgement that a clear photograph or video of the animal was taken (multiple photographs are suggested, including at least one photograph of the head scutes). If reporting within 24 hours is not possible due to distance from shore or lack of ability to communicate via phone, fax, or email, reports will be submitted as soon as possible; late reports will be submitted with an explanation for the delay. At the end of each survey season, a report will be sent to	C, O&M, D

			NMFS that compiles all information on any observations and interactions with ESA-listed species. This report will also contain information on all survey activities that took place during the season including location of gear set, duration of soak/trawl, and total effort. The report on survey activities will be comprehensive of all activities, regardless of whether ESA-listed species were observed. Any occurrence of at least 10 dead non-ESA-listed fish within established shutdown or monitoring zones must also be reported to BOEM (at renewable_reporting@boem.gov) as soon as practicable (taking into account crew and vessel safety), but no later than 24 hours after the sighting.	
12	Pile Driving – Time of Year Restrictions		The Lessee must also follow the time-of-year enhanced mitigation measures specified in the applicable Biological Opinion. The Lessee must confirm adherence to time-of-year restrictions on pile driving in the pile-driving reports submitted with the FIR. If unanticipated delays due to weather or technical problems arise that necessitate extending pile driving through otherwise restricted time periods, SouthCoast must notify BOEM in writing at least 90 days in advance of any planned pile driving, detailing the circumstances that necessitate the pile driving. The Lessee must submit to BOEM (at renewable_reporting@boem.gov) for written concurrence an enhanced survey plan to minimize the risk of exposure of NARWs to pile-driving noise.. BOEM will review the enhanced survey plan and provide comments, if any, on the plan within 30 calendar days of its submittal. The Lessee must resolve all comments on the enhanced survey plan to BOEM's satisfaction and receive BOEM's written concurrence before any pile driving occurs.	C
13	Pile Driving – Enhanced Mitigation Area Restrictions		Pile driving within the enhanced mitigation area (Figure 3.3-1) will occur only between June 1 to October 31 when NARW presence is at its lowest. Only monopile or piled jacket foundations may be used east of the enhanced mitigation area (Figure 3.3-1), which would minimize the overall structure impact on benthic prey species.	C

14	Pile Driving – Clearance and Shutdown Zone Monitoring and Plan	Measures detail required monitoring equipment and visual monitoring protocols that will occur from each monitoring vessel as summarized below. Measures intend to provide complete visual coverage of the clearance zone during the pre-start clearance period prior to pile driving and the shutdown zones during impact and vibratory pile driving. Measures specify that impact and vibratory pile driving may be initiated after dark or during daytime reduced visibility periods following protocols described fully in SouthCoast Wind's ITR. Measures state that SouthCoast will prepare a more detailed description of the anticipated efficacy of the technologies it intends to use during nighttime monitoring and describe how they will be used to monitor the pre-start clearance and shutdown zones. This will be provided to NMFS after publication of the draft ITRs so that it can be considered during preparation of the Final ITRs. Daytime Visual Monitoring: Visual monitoring will occur from the construction vessel and two dedicated PSO vessels. Daytime visual monitoring is defined by the period between nautical twilight rise and set for the region. Visual monitoring measures below intend to provide complete visual coverage of the pre- start clearance zone during the pre-start clearance period prior to pile driving and the shutdown zones during impact and vibratory pile driving. The following visual monitoring protocols include: · Three PSOs on duty will keep watch from each platform (the pile driving vessel and two PSO vessels), during the pre-start clearance period, throughout pile driving, and 30 minutes after piling is completed. · During pile driving activities, at least three PSO will be on duty on each platform during all other daylight periods. · PSOs will monitor for at least 60 minutes before, during, and 30 minutes after each piling event · One PSO will monitor areas closer to the pile being installed for smaller marine mammals using the naked eye, reticle binoculars and/or other electronic method(s) while two PSOs periodically scans farther from the pile using the mounted big eye binoculars and/or other electronic method(s). · PSO will monitor the NMFS NARW reporting systems including WhaleAlert and SAS once every 4-hour shift during Project related activities. PSOs will continue to survey the shutdown zone throughout the duration of pile installation and for a minimum of 30 minutes after piling has been completed.	The Lessee must submit a Pile-Driving Monitoring (PDM) Plan for review to BOEM (at renewable_reporting@boem.gov), BSEE (at TIMSWeb submission and protectedspecies@bsee.gov), and NMFS 180 calendar days, but no later than 120 days, before beginning the first pile-driving activities for the Project. DOI will review the PDM Plan and provide any comments on the plan within 90 calendar days of its submittal. The Lessee must resolve all comments on the PDM Plan to DOI's satisfaction before implementing the plan. If DOI provides no comments on the PDM Plan within 90 calendar days of its submittal, then the Lessee may conclusively presume DOI's concurrence with the plan. The PDM Plan must: 1. Contain information on the visual and PAM components of the monitoring describing all equipment, procedures, and protocols; 2. The PAM system must demonstrate a near-real-time capability of detection to the full extent of the 120 or 160 dB distance from the pile-driving location; 3. The PAM plan must include a detection confidence that a vocalization originated from within the clearance and shutdown zones to determine that a possible NARW has been detected. Any PAM detection of a NARW within the clearance/shutdown zone surrounding a pile must be treated the same as a visual observation and trigger any required delays in pile installation. 4. Ensure that the full extent of the harassment distances from piles are monitored for marine mammals and sea turtles to document all potential take; 5. Include number of PSOs or Native American monitors, or both, that will be used, the platforms or vessels upon which they will be deployed, and contact information for the PSO providers; 6. Include measures for enhanced monitoring capabilities in the event that poor visibility conditions unexpectedly arise, and pile driving cannot be stopped. 7. Include an Alternative Monitoring Plan that provides for enhanced monitoring capabilities in the event that poor visibility conditions unexpectedly arise, and pile driving cannot be stopped. The Alternative Monitoring Plan must also include measures for deploying additional observers, using night vision goggles, or using PAM with the goal of ensuring the ability to maintain all clearance and shutdown zones in the event of unexpected poor visibility conditions. Describe a communication plan detailing the chain of command, mode of communication, and decision authority must be described. PSOs as determined by NMFS and BOEM must be used to monitor the area of the clearance and shutdown zones. Seasonal and species-specific clearance and shutdown zones must also be described in the PDM Plan including time-of-year requirements for NARWs. A copy of the approved PDM Plan must be in the possession of the lessee representative, the PSOs, impact-hammer operators, and any other relevant designees operating under the authority of the approved COP and carrying out the requirements on site. The Lessee must minimize the exposure of ESA-listed sea turtles to noise that may result in injury or behavioral disturbance during pile-driving operations by tasking the PSOs to establish a clearance and shutdown zone for sea turtles during all pile-driving activities that is no less than 820.2 feet (250 meters) between 60 minutes	C

			before pile-driving activities, during pile driving and 30 minutes post-completion of pile-driving activity. Adherence to the 820.2-foot (250-meter) clearance and shutdown zones must be confirmed in the PSO reports.	
15	Pile Driving – Minimum Visibility and Plans	Daytime Periods of Reduced Visibility: These measures will apply during the pre-start clearance period, during active pile driving, and 30 minutes after piling is completed. • If the Level B harassment zone is obscured, the three PSOs on watch will continue to monitor the shutdown zone utilizing thermal camera systems and/or other electronic method(s) and PAM. • During nighttime or low visibility conditions, the three PSOs on watch will monitor the shutdown zone with the mounted IR camera (further described in under "Nighttime Visual Monitoring"), available handheld night vision, and/or other electronic method(s). • All on-duty PSOs will be in contact with the APSOs who will monitor the PAM systems for acoustic detections of marine mammals that are vocalizing in the area (impact pile driving only). Nighttime Visual Monitoring During nighttime operations, night vision equipment (night vision goggles) and infrared/thermal imaging technology will be used. The following nighttime piling monitoring and mitigation methods use the best currently available technology to mitigate potential impacts and result in the least practicable adverse impact.	The Lessee must not conduct pile driving operations at any time when lighting or weather conditions (e.g., darkness, rain, fog, sea state), as described below, prevent visual monitoring of the full extent of the clearance and shutdown zones: · Daytime when lighting or weather (e.g., fog, rain, sea state) conditions prevent visual monitoring of the full extent of the clearance and shutdown zones. Daytime being defined as one hour after civil sunrise to 1.5 hours before civil sunset. · Nighttime inclusive of weather conditions (e.g., fog, rain, sea state). Nighttime being defined as 1.5 hours before civil sunset to one hour after civil sunrise. In order to conduct pile driving at night and during periods of low visibility, the Lessee is required to submit two monitoring plans to NMFS and BOEM for review and approval 180 calendar days, but no later than 120 days, prior to the planned start of pile-driving: 1. Nighttime Pile Driving Plan (NPDP): The NPDP will describe the methods, technologies, monitoring zones, and mitigation requirements for any nighttime pile driving activities. In the absence of an approved NPDP, all pile driving will be initiated during daytime and nighttime pile driving could only occur if unforeseen circumstances prevent the completion of pile driving during daylight hours and was deemed necessary to continue piling during the night to protect asset integrity or safety. 2. Alternative Monitoring Plan (AMP): The AMP may include deploying additional observers, the use of alternative monitoring technologies (e.g., night vision, thermal, and infrared technologies), and the use of PAM during daytime low visibility conditions for instances when lighting or weather (e.g., fog, rain, sea state) prevent visual monitoring of the full extent of the clearance and shutdown zones. The	C

		• During nighttime operations, visual PSOs on-watch will work in three person teams observing with NVDs and/or monitoring IR thermal imaging camera system. There will also be an APSO on duty conducting acoustic monitoring in coordination with the visual PSOs. • The PSOs on duty will monitor for marine mammals and other protected species using night-vision devices with thermal clip-ons, a hand- held spotlight (one set plus a backup set), and/or other electronic methods, such that PSOs can focus observations in any direction. • If possible, deck lights will be extinguished or dimmed during night observations when using the NVDs (strong lights compromise the NVD detection abilities); alternatively, if the deck lights must remain on for safety reasons, the PSO will attempt to use the NVDs in areas away from potential interference by these lights. Since visual observations within the applicable shutdown zones can become impaired at night or during daylight hours due to fog, rain, or high sea states, visual monitoring with thermal and NVDs will be supplemented by PAM during these periods. Acoustic monitoring and mitigation measures described fully in Section 11.1.4 of SouthCoast Wind's ITR will be followed during WTG and OSP foundation installation requiring pile driving only. · At least one APSO will be on watch during all pre-clearance periods and active pile driving (daylight, reduced visibility, and nighttime monitoring). · There will be one APSO on duty who will begin monitoring at least 60 minutes prior to initiation of pile driving, continue throughout piling, and extend at least 30 minutes post-installation during both daytime and nighttime/low visibility conditions. · The PAM operator will view all PAM data streams split across two monitors while using PAMGuard (or similar) for all data visualizations. In order to ensure calls are correctly classified, SouthCoast Wind will delay/shutdown piling immediately following the detection of a potential large whale on any of the PAM data streams. Piling will not begin until the animal is no longer visible across any of the data streams for at least 30 minutes. During the pause in piling, the PAM operator will work to identify the species. · APSOs will rotate on a 4-hour basis when monitoring from a 24-hour operation vessel or base of operations · A real-time PAM system will be used to supplement visual monitoring during all pre-start clearance, piling, and post-piling	AMP will also be applicable during times when a pile was started during daylight, including all pre-start clearance and soft-start protocols, but for unforeseen reasons, piling had to continue after civil twilight. If any part of the pre-start clearance and/or soft-start protocols associated with pile driving are conducted after civil twilight, the nighttime pile driving monitoring measures will be required. The AMP and NPDP should include, but is not limited to the following information: · Identification of night vision devices (e.g., mounted thermal/IR camera systems, hand-held or wearable NVDs, IR spotlights), if proposed for use to detect protected marine mammal and sea turtle species. · The AMP and NPDP must demonstrate (through empirical evidence) the capability of the proposed monitoring methodology to detect marine mammals and sea turtles within the full extent of the established clearance and shutdown zones (i.e., species can be detected at the same distances and with similar confidence) with the same effectiveness as daytime visual monitoring (i.e., same detection probability). Only devices and methods demonstrated as being capable of detecting marine mammals and sea turtles to the maximum extent of the clearance and shutdown zones will be acceptable. · Evidence and discussion of the efficacy (range and accuracy) of each device proposed for low visibility and nighttime monitoring must include an assessment of the results of field studies (e.g., Thayer Mahan demonstration), as well as supporting documentation regarding the efficacy of all proposed alternative monitoring methods (e.g., best scientific data available). · Procedures and timeframes for notifying NMFS and BOEM of SouthCoast Wind's intent to pursue nighttime pile driving. · Reporting procedures, contacts and timeframes. · BOEM may request additional information, when appropriate, to assess the efficacy of the AMP and NPDP.	

		monitoring periods. · All on-duty PSOs will be in contact with the APSO on duty, who will monitor the PAM systems for acoustic detections of marine mammals that are vocalizing in the area. · For real-time PAM systems, at least one APSO will be designated to monitor each system by viewing data or data products that are streamed in real-time or near real-time to a computer workstation and monitor located on a Project vessel or onshore. · The PAM operator will inform the PSOs on duty of animal detections approaching or within the applicable mitigation zones via the data collection software system (i.e., Mystcetus or similar system) or other direct forms of communication (radio, phone, messaging app). The PSO will then be responsible for requesting that any necessary mitigation procedures are implemented. · The PAM system will have the capability of monitoring up to 10 km from the pile. · The PAM system will not be located on the pile installation vessel to reduce masking of marine mammal sounds. · A PAM Plan will be submitted to NMFS and BOEM prior to the planned start of pile driving		
16	Pile Driving – Pre-clearance Monitoring	A pre-start clearance period will be implemented for all foundation installation occurring both inside and outside the 20-kilometer area of concern. For foundations installed within the 20-km area of concern (June 1 through October 15), a minimum visibility zone of 4,900 m for pin pile and 7,500 meters for monopile installation will be implemented. For OSP foundations (and WTG jacket foundations, if installed) installed throughout the rest of the Lease Area (outside the area of concern), a minimum visibility zone of 2,600 m for pin pile and 3,700 meters for monopile and pin pile installation will be implemented. For impact pile driving, PAM will begin 60-minutes prior to the start of pile driving. Pre- start clearance zones will follow the same zone sizes as outlined under “Pile Driving – Shutdown Zones”. · Visual monitoring will begin at least 60 minutes prior to the start of impact pile driving and 30 minutes prior to the start of vibratory pile driving. · To begin the clearance process, PSOs will visually clear (i.e., confirm no observation of marine mammals) the relevant minimum visibility zone for 30 minutes immediately prior to commencing foundation installation activities. If PSOs cannot visually monitor the relevant minimum visibility zone prior to the start of pile driving, pile driving operations will not commence. · Once the clearance process has begun, visual monitoring	The Lessee must use visual monitoring by three PSOs during vibratory pile-driving activities. The Lessee must ensure that PSOs are on a dedicated PSO vessel and establish clearance zones for NARWs to be used between 60 minutes before pile-driving activities and 30 minutes post- completion of pile-driving activity. For all ESA-listed Mysticete whales and sperm whales, a clearance zone of 4,921 feet (1,500 meters) is to be established. For sea turtles, a clearance zone of 1,640 feet (500 meters) is to be established. Vibratory pile driving may begin only after PSOs have confirmed all clearance zones are clear of marine mammals. Vibratory pile driving must be suspended if a marine mammal is visually observed by PSOs within the shutdown zone. Vibratory pile driving may begin only if all clearance zones are fully visible (e.g., not obscured by darkness, rain, fog, or snow) for at least 30 minutes as determined by the lead PSO. If conditions such as darkness, rain, fog, or snow prevent the visual detection of marine mammals in the clearance zones, construction activities must not begin until the full extent of all clearance zones are fully visible as determined by the lead PSO.	C

		will be conducted (including the use of IR and NVD systems, as appropriate) and PAM for at least 60 minutes prior to a soft-start.. · If a marine mammal is observed entering or within the relevant clearance zones, pile driving activity will be delayed. · An acoustic detection localized to a position within the relevant clearance zone(s) will trigger a delay. · Impact and/or vibratory pile driving may commence when either the marine mammal(s) has voluntarily left the specific clearance zone and had been visually or acoustically confirmed beyond that clearance zone, or, when the additional time period has elapsed with no further sighting or acoustic detection (i.e., 15 minutes for odontocetes [excluding sperm whales] and pinnipeds, and 30 minutes for sperm whales and baleen whales [including NARWs]). In cases where these criteria cannot be met, pile driving may restart only if necessary to maintain pile stability at which time SouthCoast Wind will use the lowest hammer energy practicable to maintain stability.		
17	Pile Driving – Soft Start Procedure	Soft start procedures will be followed, at the beginning of each pile driving event or any time pile driving has stopped for longer than 30 minutes. A soft start procedure will not begin until the relevant clearance zone has been cleared by the visual PSO or APSOs. If a marine mammal is detected within or about to enter the relevant clearance zone, prior to or during the soft-start procedure, pile driving will be delayed until the animal has been observed exiting the relevant clearance zone or until an additional time period has elapsed with no further sighting (i.e., 15 minutes for odontocetes [excluding sperm whales] and pinnipeds and 30 minutes for sperm whales and baleen whales [including NARWs]).	The Lessee must implement soft start techniques for all impact pile-driving, both at the beginning of a monopile installation and at any time following the cessation of impact pile-driving of 30 minutes or longer. The soft start procedure must include a minimum of 20 minutes of 4-6 strikes/minute at 10-20 percent of the maximum hammer energy.	C

18	Pile Driving – Shutdown Require-ments	If a marine mammal is detected within or about to enter the relevant clearance zone, prior to or during the soft-start procedure, pile driving will be delayed until the animal has been observed exiting the relevant clearance zone or until an additional time period has elapsed with no further sighting (i.e., 15 minutes for odontocetes [excluding sperm whales] and pinnipeds and 30 minutes for sperm whales and baleen whales [including NARWs]). If conditions change such that PSOs cannot monitor the relevant shutdown zone following the commencement of pile driving, the PSO will request an immediate shutdown. If a marine mammal is detected entering or within the respective shutdown zone after pile driving has commenced, an immediate shutdown of pile driving will be requested unless the Chief Engineer or Vessel Captain determine shutdown is not feasible. If a shutdown is not feasible at that time in the installation process due to a risk of injury or loss of life to an individual or risk of damage to a vessel that creates risk of injury or loss of life for individuals, or the risk of jeopardizing the installation process (pile refusal or instability), a reduction in the hammer energy of the greatest extent possible will be implemented. The shutdown zone will be continually monitored by PSOs and APSOs during any pauses in pile driving. If a marine mammal is sighted within the shutdown zone during a pause in piling, resumption of pile driving will be delayed until the animal(s) has exited the relevant shutdown zone or an additional time period has elapsed with no further sighting of the animal that triggered the shutdown (15 minutes for odontocetes [excluding sperm whales] and pinnipeds and 30 minutes for sperm whales and baleen whales [including NARWs]). Following shutdown, pile driving will restart using the same procedure described above.	At all times of the year, any unidentified whale sighted by a PSO within 6,562 feet (2,000 meters) of the pile must be treated as if it were a NARW and trigger any required pre-construction delay or shutdowns during pile installation. Ensure that vibratory pile-driving operations are carried out in a way that minimizes the exposure of listed sea turtles to noise that may result in injury or behavioral disturbance, PSOs will establish a 1,640-foot (500-meter) shutdown zone for all pile-driving activities. Adherence to the 1,640-foot (500-meter) shutdown zones must be reflected in the PSO reports. Any visual detection of sea turtles the 500-meter shutdown zones must trigger the required shutdown in pile installation. Upon a visual detection of a sea turtles entering or within the shutdown zone during pile-driving, SouthCoast Wind must shut down the pile-driving hammer (unless activities must proceed for human safety or for concerns of structural failure) from when the PSO observes, until: 1) The lead PSO verifies that the animal(s) voluntarily left and headed away from the clearance area; or 2) 30 minutes have elapsed without re-detection of the sea turtle(s) by the lead PSO Additionally, if shutdown is called for but SouthCoast Wind determines shutdown is not technically feasible due to human safety concerns or to maintain installation feasibility, reduced hammer energy must be implemented, when the lead engineer determines it is technically feasible to do so.	C
19	Pile Driving – Clearance and Shutdown Zones	The ranges of shutdown zones in the table below are based upon the Level A exposure ranges with 10 dB of noise attenuation for foundation installation across Year 1 and Year 2. If the shutdown zone is equivalent to the "NAS perimeter", this means the outside perimeter of the NAS. Therefore, any animals occurring within the NAS will trigger a shutdown. The NARW shutdown zones (outlined below) are based on the requirement that a visual or	The Lessee must reduce any unanticipated impacts on marine mammals and sea turtles by adjusting pile-driving monitoring protocols for clearance and shutdown zones, taking into account weekly monitoring results (see BA-28). Any proposed changes to monitoring protocols must be concurred with by DOI and NMFS before those protocols are implemented. Any reduction in the size of the clearance and shutdown zones for each foundation type must be based on at least 3 measurements submitted to BOEM and NMFS for review. For each 4,921 feet (1,500 meters) that a	C

		acoustic observation of a NARW at any distance will result in immediate shutdown measures. Foundation installations include 9/16 m (tapered) diameter WTG monopiles and 4.5 m WTG and OSP jacket pin piles installed using impact pile driving only during Year 1. During Year 2, foundations may be installed using only impact pile driving or may use a combination of vibratory and impact pile driving. The shutdown zones are the largest zone sizes expected to result from foundation installations for each installation schedule, except in cases where a single species (e.g., fin whales) had a much larger modeled exposure range than other large cetaceans and the next largest zone size was selected. If smaller diameter piles, lower maximum hammer energies and/or total strikes per pile, or more effective NAS are decided upon and used during the construction activities, modeled Level A exposure ranges applicable to those revised parameters will be used, likely resulting in shorter shutdown distances than those shown below based on current maximum pile size and hammer energy assumptions. Further details of installation scenarios and cetacean frequency classifications can be found in SouthCoast Wind's ITR.	clearance or shutdown zone is increased based on the results from SFVP, the Lessee must deploy additional platforms and must deploy additional observers on those platforms. Should the shutdown zone for sei, fin, humpback, and sperm whales be decreased the full extent of the Level B harassment distance must be monitored using PAM and visual observations. Decreases in the distance of the clearance or shutdown zones for NARW and sea turtles are not permitted. If a visually triggered NARW Slow Zone overlaps with the NARW Shutdown Zone, the PAM system detection must extend to the largest practicable detection zone. PSOs must treat any PAM detection of NARWs in the clearance and shutdown zones the same as a visual detection and call for the required delays or shutdowns in pile installation.	
20	Pile Driving – Post-piling monitoring	PSOs will continue to survey the shutdown zone throughout the duration of pile installation and for a minimum of 30 minutes after piling has been completed.		C
21	Pile Driving – Noise Attenuation Systems	Several recent studies summarizing the effectiveness of noise attenuation systems (NAS) have shown that broadband sound levels are likely to be reduced by anywhere from 7 to 17 dB, depending on the environment, pile size, and the size, configuration and number of systems used, such as single bubble curtain, large bubble curtains with two rings, double bubble curtains, etc. Combinations of systems (e.g., double big bubble curtain, hydrosound damper plus single big bubble curtain) potentially achieve much higher attenuation. The type and number of NAS to be used during construction have not yet been determined. Based on prior measurements a combination of NAS is reasonably expected to achieve far greater than 10 dB broadband attenuation of impact pile driving sounds.	The Lessee must apply noise reduction technologies during all pile driving activities to minimize marine species noise exposure. The range measured to the Level B harassment threshold when noise mitigation devices are in use must be consistent with or less than the range modeled assuming 10 dB attenuation, determined via sound field verification of the modeled isopleth distances (e.g., Level B harassment distances). If a bubble curtain is used, the following requirements apply: 1. Bubble curtains must distribute air bubbles around 100 percent of the piling perimeter for the full depth of the water column. 2. The lowest bubble ring must be in contact with the seafloor for the full circumference of the ring, and the weights attached to the bottom ring must ensure 100 percent seafloor contact. 3. No parts of the ring or other objects may prevent full seafloor contact of the lowest bubble ring. The Lessee must train personnel in the proper balancing of air flow to the bubblers. The Lessee must submit an inspection and performance report to DOI within 72 hours following the performance test. Any modifications to attenuation devices to meet the performance standards must occur before impact driving occurs and maintenance or modifications completed must be included in the report. The Lessee must ensure PSOs follow all pile driving reporting instructions and requirements.	C

22	Pile Driving – Sound Field Verification	A detailed plan for Sound Source Verification (SSV) will be developed and submitted to NMFS prior to planned start of pile driving. Measurements of each pile type (monopiles and/or piled jackets), on at least the first three piled foundations to be installed, will be conducted to determine the sound levels produced and effectiveness of the NAS(s). Procedures for how measurement results will be used to justify any requested changes to planned monitoring and mitigation distances. The plan will require measurement of the sound levels produced by each pile type at 750 meters and other various distances and azimuths relative to the pile location designed to gather data on sounds produced during installation scenarios specific to the Project. These measurements will be used to validate the modeled sound levels at 750 and other distances as provided in Appendix G1 of Appendix A of SouthCoast Wind's ITR. These measurements are designed to assess whether or not the distances to the Level A and Level B harassment isopleths and/or other mitigation action distances align with the distances modelled. The plan should include procedures for determining how measurements will be used to justify any changes to planned monitoring and mitigation distances. SSV will include at least one recorder in each of the four azimuths around the pile (to capture potential directivity of the sound field). Additionally, there will be 3-4 recorders along one azimuth to capture the propagation loss in at least one direction to allow assessment of the modelled Level A harassment and Level B harassment isopleths.	The Lessee must ensure that distances to the auditory injury (i.e., harm) or behavioral harassment threshold (Level A and Level B harassment respectively) for marine mammals, the harm or behavioral harassment thresholds for sea turtles, or the harm or behavioral disturbance thresholds for Atlantic sturgeon that are identified in the NMFS BiOp are no larger than those modelled assuming 10 dB re 1 μPa noise attenuation is met by conducting field verification during pile-driving. The Lessee must submit a Sound Field Verification Plan (SFVP) for review and comment to the USACE (at CENAE-R-OffshoreWind@usace.army.mil), BOEM (at renewable_reporting@boem.gov), and NMFS GARFO-PRD (at nmfs.gar.incidental-take@noaa.gov) 180 calendar days, but no later than 120 days, before beginning the first pile- driving activities for the Project. The SFVP must provide details for monitoring pile driving sound levels including thorough and abbreviated SFV, required reporting, adaptive attenuation measures, and monitoring measures consistent with Terms and Conditions of the NMFS BiOp issued under the ESA and requirements of the LOA issued under the MMPA. It is anticipated that conditions similar to those agreed to by BOEM and NMFS in recent biological opinions will be required.13 The Lessee must send all raw SFV PAM data to the NCEI Passive Acoustic Data archive within 12 months following the completion of WTG/ESP foundation installation and the Lessee must follow NCEI guidance for packaging the data and metadata. DOI will review the SFVP and provide any comments on the plan within 45 calendar days of its submittal. The Lessee must resolve all comments on the SFVP to DOI's satisfaction before implementing the plan. The Lessee may conclusively presume DOI's concurrence with the SFVP if DOI provides no comments on the plan within 90 calendar days of its submittal. The plan(s) must describe how the first three piled installation sites and installation scenarios (i.e., hammer energy and number of strikes) are representative of the rest of the piled installations and, therefore, why these piled installations will be representative of the remaining piled installations. If the monitored pile locations are different from the ones used for exposure modelling, the Lessee must provide a justification for why these locations are representative of the modeling. In the case that these sites are not determined to be representative of all other pile installation sites, the Lessee must include information on how additional piles/sites will be selected for sound field verification (SFV). The plan must also include methodology for collecting, analyzing, and preparing SFV data for submission to NMFS GARFO. The Lessee must conduct additional field measurements if it installs piles with a diameter greater than the initial piles, if it uses a greater hammer size or energy, or if it measures any additional foundations to support any request to decrease the distances specified for the clearance and shutdown zones. The Lessee must implement the SFVP requirements for verification of noise attenuation for at least 3 foundations of each pile type, in consultation with NMFS, to consider reducing zone distances (see BA-25). The Lessee must ensure that locations identified in the SFVP for each pile type are representative of other piles of that type to be installed and that the results are representative for predicting actual installation noise propagation for subsequent piles. The SFVP must describe how the	C

			effectiveness of the sound attenuation methodology will be evaluated. The SFVP must be sufficient to document impacts in Level B harassment zones for marine mammals and injury and behavioral disturbance zones for sea turtles and Atlantic sturgeon. The Noise Attenuation System (NAS) inspection/performance report must be submitted to BOEM and BSEE within 72 hours of the performance test, which must occur prior to the first pile installation as well as any additional piles for which SFV is conducted. This report must be submitted as soon as it is available, but no later than when the interim SFV report is submitted for the respective pile. The Lessee must measure pile-driving noise in the field for at least three foundations of each pile type and submit initial results to NMFS, USACE, and BOEM (at renewable_reporting@boem.gov) as soon as they are available. BOEM will discuss the results as soon as feasible. The Lessee may request modification of the clearance and shutdown zones based on these results but must meet or exceed minimum distances for threatened and endangered species specified in the Biological Opinion (e.g., 3,280 feet [1,000 meters] for large whales and 1,640 feet [500 meters] for sea turtles). If the field measurements indicate that the isopleths for noise exposure are larger than those considered in the approved COP, the Lessee must coordinate with BOEM, BSEE, NMFS, and USACE to implement additional sound attenuation measures or larger clearance or shutdown zones before driving any additional piles. NMFS does not anticipate considering any reductions in the clearance or shutdown zones for NARWs.	
23	Pile Driving – Protected Species Reporting		Within 24 hours of detection, the Lessee must report to BOEM (at renewable_reporting@boem.gov) and BSEE (at protectedspecies@bsee.gov) the sighting of any marine mammal or sea turtle in the shutdown zone that results in a shutdown or a power-down. In addition, PSOs must submit the raw data collected in the field and daily report forms including the date, time, species, pile identification number, GPS coordinates, time and distance of the animal when sighted, time the shutdown or power-down occurred, behavior of the animal, direction of travel, time the animal left the shutdown zone, time the pile driver was restarted or powered back up, and any photographs. The Lessee must submit weekly PSO and PAM monitoring reports to DOI and NMFS during pile- driving. Weekly reports must document the daily start and stop times of all pile-driving, the daily start and stop times of associated observation periods by the PSOs, details on the deployment of PSOs, and all detections of marine mammals and sea turtles. The weekly reports must be submitted to BOEM (at renewable_reporting@boem.gov), BSEE (at TIMSWeb submission and protectedspecies@bsee.gov) and NMFS Greater Atlantic Regional Fisheries Office, Protected Resources Division (at nmfs.gar.incidental- take@noaa.gov) every Wednesday during construction for the previous week (Sunday through Saturday) of monitoring of pile-driving activity. Weekly monitoring reports must include: 1. Summaries of pile-driving activities and piles installed including, start and stop times, pile locations, and PSO coverage; 2. Vessel operations (including port departures, number of vessels, type of vessel(s), and route);	C

			3. All protected species sightings; 4. Vessel strike-avoidance measures taken; and any equipment shutdowns or takes that may have occurred. Weekly reports can consist of raw data. Required data and reports provided to DOI may be archived, analyzed, published, and disseminated by BOEM. PSO data must be reported weekly (Sunday through Saturday) from the start of visual and/or PAM efforts during pile-driving activities, and every week thereafter until the final reporting period upon conclusion of pile-driving activity. Any editing, review, and quality assurance checks must be completed only by the PSO provider prior to submission to NMFS and DOI. The Lessee must submit to DOI at renewable_reporting@boem.gov and TIMSWeb submission and protectedspecies@bsee.gov a final summary report of PSO monitoring 90 days following the completion of pile driving.	
24	Pile Driving – NARW considera-tions	Potential additional measures state that the period from January through April is when the highest number of NARW are present in the region, and to reduce the need for foundation installations during this period and associated impacts to the NARW, SouthCoast Wind may conduct nighttime pile driving of monopile or piled jacket foundations during time periods when the fewest number of NARW are likely to be present in the region. These measures will be finalized through continued negotiations between NOAA and SouthCoast Wind. Specific measures as they currently stand include: Concentrating construction activities when NARW are less likely to be present within the region (May 15 through December 31), including in the Lease Area. Specific monitoring tools and plans will be developed as a part of the ongoing ITR Application process, but may include the use of advanced infrared systems, near real-time PAM, autonomous underwater vehicles, autonomous aerial vehicles, or other advanced technologies that could improve the probability of detecting marine mammals at night. As a result of concerns related to potential NARW use of the Nantucket Shoals region outside of the January−April seasonal restriction period, additional mitigation and monitoring measures have been proposed in a NARW mitigation and monitoring plan for pile driving to further minimize the potential for impacts. These measures also include the commitment to only use impact pile driving in specified areas of the Lease Area (Project 1) and intends to monitor and mitigate for NARW within the Level B harassment zones for impact pile driving (in addition to the requirement that a visual or acoustic observation of NARW at any distance will result in immediate shutdown zone measures [see Pile Driving – Shutdown Zones]). These measures also include a commitment that no pile driving for foundation	If a visually triggered NARW Slow Zone overlaps with the NARW Shutdown Zone, the PAM system detection must extend to the largest practicable detection zone. PSOs must treat any PAM detection of NARWs in the clearance and shutdown zones the same as a visual detection and call for the required delays or shutdowns in pile installation.	C

		installations will occur from January 1 through May 14 each year. On top of the seasonal description described, no pile driving for WTG or OSP foundation installations will occur within the 20-km area of concern during the month of May or after October 15. Additional mitigation and monitoring measures include: Vessel-Based Visual Monitoring: A total of three monitoring vessels will conduct visual monitoring for NARW and other marine mammals, with three PSOs on duty on each monitoring vessel during pre-start clearance and pile driving periods. In addition, when pile driving occurs inside the NMFS 20-km Area of Concern during August - October 15 and anywhere in the Lease Area between May 15 - 31 and in December, SouthCoast Wind will add one additional dedicated vessel, for a total of four monitoring vessels. Acoustic Monitoring: Acoustically monitor a larger distance than the Level B harassment zones by deploying a PAM array to cover a 15-km zone for monopile installation and a 10-km zone for pin pile installation. NARW calls localized within the relevant PAM monitoring zone will result in a delayed start or shutdown of pile driving. Refer to the North Atlantic Right Whale Monitoring and Mitigation Plan for Pile Driving, for additional details		
25	Marine Debris		The Lessee must ensure that vessel operators, employees, and contractors engaged in offshore activities pursuant to the approved COP complete marine trash and debris awareness training annually. The training consists of two parts: (1) viewing a marine trash and debris training video or slide show (described below); and (2) receiving an explanation from management personnel that emphasizes their commitment to the requirements. The marine trash and debris training videos, training slide packs, and other marine debris related educational material may be obtained at https://www.bsee.gov/debris or by contacting BSEE. The training videos, slides, and related material may be downloaded directly from the website. Operators engaged in marine survey activities must continue to develop and use a marine trash and debris awareness training and certification process that reasonably assures that their employees and contractors are in fact trained. The training process will include the following elements: 1. Viewing of either a video or slide show by the personnel specified above; 2. An explanation from management personnel that emphasizes their commitment to the requirements; 3. Attendance measures (initial and annual); and 4. Recordkeeping and the availability of records for inspection by DOI. By January 31 of each year, the Lessee will submit to DOI an annual report that describes its marine trash and debris awareness training process and certifies that the training process has been followed for the previous calendar year. The Lessee will	C, O&M, D

			send the reports via email to BOEM (at renewable_reporting@boem.gov) and to BSEE (at TIMSWeb submission and protectedspecies@bsee.gov). The Lessee must report to DOI (using the email address listed on DOI's most recent incident reporting guidance) all lost or discarded marine trash and debris. This report must be made monthly and submitted no later than the fifth day of the following month. The Lessee is not required to submit a report for those months in which no marine trash and debris was lost or discarded. In addition, the Lessee must submit a report within 48 hours of the incident (48-hour Report) if the marine trash or debris could: (a) cause undue harm or damage to natural resources, including their physical, atmospheric, and biological components, with particular attention to marine trash or debris that could entangle or be ingested by marine protected species; or (b) significantly interfere with OCS uses (e.g., because the marine trash or debris is likely to snag or damage fishing equipment or presents a hazard to navigation). The information in the 48-hour report must be the same as that listed for the monthly report, but only for the incident that triggered the 48-hour Report. The Lessee must report to DOI via email to BOEM (at renewable_reporting@boem.gov) and BSEE (at TIMSWeb submission and protectedspecies@bsee.gov) if the object is recovered and, as applicable, describe any substantial variance from the activities described in the Recovery Plan that were required during the recovery efforts. The Lessee must include and address information on unrecovered marine trash and debris in the description of the site clearance activities provided in the decommissioning application required under 30 C.F.R. § 585.906. Materials, equipment, tools, containers, and other items used in OCS activities which are of such shape or properly secured to prevent loss overboard. All markings must clearly identify the owner and must be durable enough to resist the effects of the environmental conditions to which they may be exposed.	
26	Marine Debris: Periodic Underwater Surveys, Reporting of Monofilament and Other Fishing Gear Around WTG Foundations		The Lessee must monitor indirect impacts associated with charter and recreational fishing gear lost from expected increases in fishing around WTG foundations by surveying at least 10 different WTGs in the SouthCoast Wind Lease Area annually. Survey design and effort may be modified based upon previous survey results with review and concurrence by DOI. The Lessee must conduct surveys by remotely operated vehicles, divers, or other means to determine the frequency and locations of marine debris. The Lessee must report the results of the surveys to BOEM (at renewable_reporting@boem.gov) and BSEE (at OSWsubmittals@bsee.gov) in an annual report, submitted by April 30 for the preceding calendar year. Reports must be submitted in Word format. Photographic and videographic materials will be provided on a drive in a lossless format such as TIFF or Motion JPEG 2000. Reports must include daily survey reports that include the survey date, contact information of the operator, location, and pile identification number, photographic and/or video documentation of the survey and debris encountered, any animals sighted, and the disposition of any located debris (i.e., removed or left in place). Required data and reports may be archived, analyzed, published, and disseminated by BOEM. BMPs will be coordinated with NOAA's marine debris program.	O&M, D

27	HRG Surveys - Visual Monitoring	Measures for HRG surveys apply only to sound sources with operating frequencies below 180 kHz. There are no mitigation or monitoring protocols required for sources operating >180 kHz. HRG surveys can occur either during daylight hours only or 24-hours per day. Measures specify the requirements for equipment and PSO visual monitoring protocols during daylight, low visibility, and nighttime conditions as summarized below: · Four PSOs on board any 24-hour survey vessels. · Two PSOs on board any daylight survey vessels. · One PSO on watch during all daylight surveying. · Two PSOs on watch during nighttime surveying. · PSOs will begin observation of the shutdown zones prior to initiation of HRG survey operations and will continue throughout the survey activity and/or while equipment operation below 180 kHz is in use. · PSO will monitor the NMFS NARW reporting systems including WhaleAlert and SAS once every 4-hour shift during Project related activities. Daytime Visual Monitoring One PSO on watch during pre-start clearance periods and all source operations. PSOs will use reticle binoculars and the naked eye to scan the shutdown zone for marine mammals Nighttime and Low Visibility Monitoring The Lead PSO will determine if conditions warrant implementing reduced visibility protocols. Two PSOs on watch during pre-start clearance periods, all operations, and for 30 minutes following use of HRG sources operating below 180 kHz. Each PSO will monitor for marine mammals and other protected species using night-vision goggles with thermal clip-ons and a hand-held spotlight (one set plus a back-up set), such that PSOs can focus observations in any direction.	See Appendix A.2	C, O&M, D
28	HRG Surveys – Shutdown Zones	PSOs will establish and monitor marine mammal shutdown zones. Distances to shutdown zones will be from any acoustic sources, not the distance from the vessel. Shutdown zones will be as follows: · 500 m from NARW for use of impulsive acoustic sources (e.g., boomers and/or sparkers) and non-impulsive nonparametric sub-bottom profilers · 100 m from all other marine mammals for use of impulsive acoustic sources (e.g., boomers and/or sparkers), except for delphinids when approaching the vessel or towed acoustic sources, shutdown is not required	See Appendix A.2	C, O&M, D

29	HRG Surveys – Pre-start Clearance	PSOs will establish and monitor pre-start clearance zones. Distances to pre-start clearance zones for HRG surveys will be the same as those for shutdown zones described above. · PSOs will conduct 30 minutes of pre-start clearance observation prior to the initiation of HRG operations. · The pre-start clearance zones must be visible using the naked eye or appropriate technology during the entire pre-start clearance period for operations to start. If the pre-start clearance zones are not visible, source operations <180 kHz will not commence · Ramp-up may not be initiated if any marine mammal(s) is detected within its respective pre-start clearance zone. · If a marine mammal is observed entering or within the pre-start clearance zones during the pre-start clearance period, relevant acoustic sources must not be initiated until the marine mammal(s) is confirmed by visual observation to have exited the relevant zone, or, until an additional time period has elapsed with no further sighting of the animal (15 minutes for odontocetes [excluding sperm whales] and pinnipeds and 30 minutes for sperm and baleen whales [including NARWs]).	See Appendix A.2	C, O&M, D
30	HRG Surveys – Ramp-Up	The ramp-up procedure will not be initiated during periods of inclement conditions or if the pre-start clearance zones cannot be adequately monitored by the PSOs, using the appropriate visual technology for a 30-minute period immediately prior to ramp-up. Ramp-up will begin with the power of the smallest acoustic equipment at its lowest practical power output. When technically feasible, the power will then be gradually turned up and other acoustic sources added in a way such that the source level would increase gradually. Ramp-up activities will be delayed if marine mammal(s) enters its respective shutdown zone. Ramp-up will continue if the animal(s) has been observed exiting its respective shutdown zone, or until an additional time period has elapsed with no further sighting of the animal (15 minutes for odontocetes [excluding sperm whales] and 30 minutes for sperm and baleen whales [including NARWs]).	See Appendix A.2	C, O&M, D
31	HRG Surveys – Shutdowns	Immediate shutdown of impulsive, non-parametric HRG survey equipment other than CHRIP sub-bottom profilers operating at frequencies <180 kHz is required if a marine mammal is observed within or entering the relevant shutdown zone. Any PSO on duty has the authority to call for shutdown of acoustic sources. When there is certainty regarding the need for mitigation action on the basis of visual detection, the relevant PSOs must call for such action immediately. Upon implementation of a shutdown, survey equipment may be	See Appendix A.2	C, O&M, D

		reactivated when all marine mammals that triggered the shutdown have been confirmed by visual observation to have exited the relevant shutdown zone or an additional time period has elapsed with no further sighting of the animal that triggered the shutdown (15 minutes for odontocetes [excluding sperm whales] and pinnipeds, and 30 minutes sperm whales and other baleen whales [including NARWs]). If the acoustic source is shut down for reasons other than mitigation (e.g., mechanical difficulty) for less than 30 minutes, the acoustic sources may be reactivated as soon as is practicable at full operational level if PSOs have maintained constant visual observation during the shutdown and no visual detections of marine mammals occurred within the applicable shutdown zone during that time. If the acoustic source is shut down for a period longer than 30 minutes or PSOs were unable to maintain constant observation, then ramp-up and pre-start clearance procedures will be initiated. If delphinids are visually detected approaching the vessel or towed acoustic sources, shutdown is not required.		
32	UXO Detonation – General Measures and Seasonal Restriction	For UXOs that are positively identified in proximity to planned activities on the seabed, several alternative strategies will be considered prior to detonating the UXO in place. These may include relocating the activity away from the UXO (avoidance), moving the UXO away from the activity (lift and shift), cutting the UXO open to apportion large ammunition or deactivate fused munitions, using shaped charges to reduce the net explosive yield of a UXO (low-order detonation), or using shaped charges to ignite the explosive materials and allow them to burn at a slow rate rather than detonate instantaneously (deflagration). Only after these alternatives are considered would a decision to detonate the UXO in place be made. If deflagration is conducted, mitigation and a monitoring measure would be implemented as if it was a high order detonation based on UXO size. Decision on removal method will be made in consultation with a UXO specialist and in coordination with the agencies with regulatory oversite of UXO. For detonations that cannot be avoided due to safety considerations, a number of mitigation measures will be employed by SouthCoast Wind, as described in the ITR (LGL 2024). No more than a single UXO will be detonated in a 24- hour period, and there are no UXO detonations planned between January and April	The Lessee must comply with applicant-proposed measures for UXO detonations in addition to BOEM-required measures for ESA-listed species as summarized below: · Comply with modified visual and acoustic monitoring measures for UXO detonations: Two PSO vessels, each with three PSOs on watch, will visually monitor the UXO clearance zone at least 60 minutes before a detonation event, during the event, and for a period of 30 minutes after the event. · The dedicated APSO must acoustically monitor to a minimum radius of 8.8 miles (14,100 meters) around the detonation site. The Lessee must comply with applicant-proposed clearance zones for UXO detonations for the PTS distances for listed species be established for the specified net explosive weight and associated PTS threshold exposure distance.	C

33	UXO Detonation – Pre- start Clearance and Post-Detonation Monitoring	All mitigation and monitoring zones assume the use of a NAS resulting in a 10 dB reduction of noise levels. Mitigation and monitoring zones specific to marine mammal hearing groups for the five different charge weight bins are available in the ITR A 60-minute pre-start clearance period will be implemented prior to any UXO detonation The pre-start clearance zones in the table below must be fully visible for at least 60 minutes and all marine mammal(s) must be confirmed to be outside of the pre-start clearance zone for at least 30 minutes prior to commencing detonation The pre-start clearance zone size will be dependent on the charge weight of the identified UXO, which will be determined prior to detonation. If the charge weight is determined to be unknown or uncertain, the largest pre-start clearance zone size (charge weight bin E12) will be used throughout the pre-start clearance period. All marine mammals must be confirmed to be out of the pre-start clearance zone prior to initiating detonation If a marine mammal is observed entering or within the relevant pre-start clearance zones prior to the initiation of detonation, the detonation must be delayed The detonation may commence when either the marine mammal(s) has voluntarily left the respective pre-start clearance zone and have been visually confirmed beyond that pre-start clearance zone, or after 15 minutes for odontocetes [excluding sperm whales] and pinnipeds, and 30 minutes for sperm and baleen whales [including NARWs] with no further sightings. Post-detonation monitoring will occur for 30 minutes. Mitigation and Monitoring Zones associated with in-situ UXO detonation of the largest charge weight (E12), with 10 dB NAS * Pre-start clearance zones were calculated by selecting the largest Level A threshold (the larger of either the PK or SEL noise metric). The chosen values were the most conservative per charge weight bin across each of the four modeled sites. Please refer to SouthCoast Wind’s ITR (LGL) for monitoring zones for charge weights E4 (2.3 kg) to E10 (2.27 kg)		C
34	UXO Detonation – Visual Monitoring	Measures as described in SouthCoast Wind’s ITR (LGL 2024) specify the requirements for equipment and protocols for PSO visual monitoring during UXO detonation. The number of vessels deployed will depend on the pre-start clearance zone size shown in the table above and safety set back distance from the detonation. A sufficient number of vessels will be deployed to cover the clearance and shutdown zones. PSOs will visually monitor the Low Frequency Cetacean pre-start clearance zone depending on the identified charge weight.		C

		This zone encompasses the maximum Level A exposure ranges for all marine mammal species except harbor porpoise, where Level A take has been requested due to the large zone sizes associated with High Frequency cetaceans Detonation Vessel Measures Three PSOs on duty on the detonation vessel Three PSOs will maintain watch at all times during the pre-start clearance period and 30 minutes after the detonation event. Each PSO will be responsible for monitoring a 120-degree sector with the unaided eye and reticle binoculars to provide additional coverage beyond the pre- start clearance zone away from the detonation location. The three visual PSOs onboard the detonation vessel will monitor out to the relevant pre-start clearance zone (as outlined in the table above) at least 30 minutes prior to a detonation event; there will be a PAM operator on duty conducting acoustic monitoring in coordination with the visual PSOs during all pre-start clearance periods and post-detonation monitoring periods		
35	FMP & BMP – Vessel Separation Distances	Vessels will maintain the following separation distances from marine mammals: · > 500 m distance from any sighted NARW or an unidentified large marine mammal · > 100 m from sperm whales and non-NARW baleen whales · > 50 m from all delphinid cetaceans and pinnipeds, with the exception of animals approaching the vessel (e.g., bow-riding dolphins), in which case the vessel operator must avoid excessive speed or abrupt changes in direction.		Pre-C, C, O&M
36	FMP & BMP – Gear-Require-ments,	The following mitigation measures will be used to minimize the potential for marine mammal capture during the research trawling: · All gear restrictions, closures, and other regulations set forth by take reduction plans (e.g., Harbor Porpoise Take Reduction Plan, Atlantic Large Take Whale Reduction Plan, etc.) will be adhered to as with typical scientific fishing operations to reduce the potential for interaction or injury; · Marine mammal monitoring will be conducted by the captain and/or a member of the scientific crew before, during, and after haul back. When the captain and/or member of the scientific crew are designated as the dedicated PSO, it is their sole responsibility for the duration of the haul; · Trawl operations will commence as soon as possible once the vessel arrives on station; the target tow time will be limited to 20 minutes; · Marine mammal visual observations will be conducted when sampling and during vessel transits to/from sampling stations and	The Lessee must develop monitoring plans and conduct fisheries research and monitoring surveys, including the benthic survey. The Lessee must conduct these surveys for durations of, at a minimum, 1 year during pre-construction, 1 year during construction, and 2 years post- construction. The Lessee must submit an annual report within 90 days of the completion of each survey season to DOI (renewable_reporting@boem.gov) that includes results and analyses as described in the monitoring plans. The Lessee must share data in accordance with their data sharing plan. The Lessee must comply with applicant-proposed measures for Fisheries and Benthic Monitoring Surveys in addition to BOEM-required measures for ESA-listed species as summarized below: Trap/Pot/Gillnet Gear: · All sampling gear will be hauled at least once every 30 days, and gear will be removed from the water and stored on land between sampling seasons. · No surface floating buoy lines will be used. · All groundlines will be composed of sinking line. · Buoy lines will use weak links (< 1,700-lb. breaking strength) that are chosen from the list of NMFS-approved gear · Gillnet string will be anchored with a Danforth-style anchor with a minimum	C, O&M, D

		will maintain visual monitoring effort during the entire period of time that trawl gear is in the water (i.e., throughout gear deployment, fishing, and retrieval). If marine mammals are sighted before the gear is fully removed from the water, the most appropriate action to avoid interaction will be taken. · Gear will not be deployed if marine mammals are observed within the area and if a marine mammal is deemed to be at risk or interaction, all gear will be immediately	holding strength of 22 lbs. · Knot-free buoy lines will be used to the extent practicable. · All gillnet sampling times will be limited to no more than 24 hours to reduce mortality of entangled sea turtles and sturgeon. If weather or other safety concerns prevent retrieval of the gear within 24 hours of it being set, NMFS GARFO, Protected Resources Division (at nmfs.gar.incidental-take@noaa.gov) must be notified, and the gear must be retrieved as soon as it is safe to do so. · All buoys will be labeled as research gear, and the scientific permit number will be written on the buoy. All markings on the buoys and buoy lines will be compliant with the regulations and instructions received from staff at the Office of Protected Resources. Additional gear modification as required at the discretion of GARFO. · All vessels will have at least one survey team member onboard the trawl surveys and ventless trap surveys who has completed Northeast Fisheries Observer Program observer training (or another training in protected species identification and safe handling, inclusive of taking genetic samples from Atlantic sturgeon) within the last 5 years. · Follow documentation, incidental reporting, observation, and disentanglement and resuscitation requirements and protocols. Avoiding Protected Species Interactions: · Initiate protected species watches (visual observation) at least 15 minutes prior to sampling by scanning the surrounding waters with the naked eye and range finding binoculars. If protected species are sighted within 1 nm of the station in the 15 minutes before setting the gear, the vessel will transit to a different section of the sampling area. Trawl or gillnet gear should not be deployed if protected species are sighted near the survey vessel. · Vessels must travel 10 knots or less in any Seasonal Management Area (SMA), Slow Zone/Dynamic Management Area (DMA). All vessel operators must check for information regarding mandatory or voluntary ship strike avoidance (SMAs, DMAs, Slow Zones) and daily information regarding North Atlantic right whale sighting locations. Sightings should not be used as the primary or sole means for avoiding right whales, as they only represent locations where right whales were at one point in time. In the event that sea turtles become entangled, the NMFS stranding hotline must be contacted immediately. Vessels deploying fixed gear (e.g., pots/traps) must have adequate disentanglement equipment onboard, such as a (i.e., knife and boathook) onboard. Any disentanglement must occur consistent with the Northeast Atlantic Coast STDN Disentanglement Guidelines at https://www.reginfo.gov/public/do/DownloadDocument?objectID=102486501 and the procedures described in “Careful Release Protocols for Sea Turtle Release with Minimal Injury” (NOAA Technical Memorandum 580; https://repository.library.noaa.gov/view/noaa/3773). Any sea turtles or Atlantic sturgeon caught or retrieved in any fisheries survey gear must first be identified to species or species group. Each ESA-listed species caught or retrieved must then be documented using appropriate equipment and data collection forms. Biological data collection, sample collection, and tagging activities	

			must be conducted as outlined below. Live, uninjured animals must be returned to the water as quickly as possible after completing the required handling and documentation. A. The Sturgeon and Sea Turtle Take Standard Operating Procedures must be followed (https://media.fisheries.noaa.gov/2021-11/ Sturgeon%20%26%20Sea%20Turtle%20Take%20SOPs_external_11032021.pdf). b. Survey vessels must have a passive integrated transponder (PIT) tag reader onboard capable of reading 134.2 kHz and 125 kHz encrypted tags (e.g., Biomark GPR Plus Handheld PIT Tag Reader). This reader must be used to scan any captured sea turtles and sturgeon for tags, and any tags found must be recorded on the take reporting form (see below). c. Genetic samples must be taken from all captured Atlantic sturgeon (alive or dead) to allow for identification of the DPS of origin of captured individuals and tracking of the amount of incidental take. This must be done in accordance with the Procedures for Obtaining Sturgeon Fin Clips (https://media.fisheries.noaa.gov/dam-migration/ sturgeon_genetics_sampling_revised_june_2019.pdf). i. Fin clips must be sent to a NMFS-approved laboratory capable of performing genetic analysis and assignment to DPS of origin. SouthCoast Wind must cover all reasonable costs of the genetic analysis. Arrangements for shipping and analysis must be made before samples are submitted and confirmed in writing to NMFS within 60 days of the receipt of the Project BiOp with ITS. Results of genetic analyses, including assigned DPS of origin must be submitted to NMFS within 6 months of the sample collection. ii. Subsamples of all fin clips and accompanying metadata forms must be held and submitted to a tissue repository (e.g., the Atlantic Coast Sturgeon Tissue Research Repository) on a quarterly basis. The Sturgeon Genetic Sample Submission Form is available for download at: https://media.fisheries.noaa.gov/2021-02/ Sturgeon%20Genetic%20Sample%20Submission%20sheet%20for%20S7_v1.1_Form%20 to%20Use.xlsx?nullhttps://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-take-reporting-programmatics-greater-atlantic. D. All captured sea turtles and Atlantic sturgeon must be documented with required measurements and photographs. The animal's condition and any marks or injuries must be described. This information must be entered as part of the record for each incidental take. Particularly, a NMFS Take Report Form must be filled out for each individual sturgeon and sea turtle (download at: https://media.fisheries.noaa.gov/2021-07/ Take%20Report%20Form%2007162021.pdf?null) and submitted to NMFS as described in the take notification measure below.	
37	Ventless Trap Surveys		The Lessee must develop monitoring plans and conduct fisheries research and monitoring surveys, including the benthic survey. The Lessee must conduct these surveys for durations of, at a minimum, 1 year during pre-construction, 1 year during construction, and 2 years post- construction. The Lessee must submit an annual report within 90 days of the completion of each survey season to DOI (renewable_reporting@boem.gov) that includes results and analyses as described in the monitoring plans. The Lessee must share data in accordance with their data	C, O&M, D

			sharing plan. The Lessee must comply with applicant-proposed measures for Fisheries and Benthic Monitoring Surveys in addition to BOEM-required measures for ESA-listed species as summarized below: Trap/Pot/Gillnet Gear: · All sampling gear will be hauled at least once every 30 days, and gear will be removed from the water and stored on land between sampling seasons. · No surface floating buoy lines will be used. · All groundlines will be composed of sinking line. · Buoy lines will use weak links (< 1,700-lb. breaking strength) that are chosen from the list of NMFS-approved gear · Gillnet string will be anchored with a Danforth-style anchor with a minimum holding strength of 22 lbs. · Knot-free buoy lines will be used to the extent practicable. · All gillnet sampling times will be limited to no more than 24 hours to reduce mortality of entangled sea turtles and sturgeon. If weather or other safety concerns prevent retrieval of the gear within 24 hours of it being set, NMFS GARFO, Protected Resources Division (at nmfs.gar.incidental-take@noaa.gov) must be notified, and the gear must be retrieved as soon as it is safe to do so. · All buoys will be labeled as research gear, and the scientific permit number will be written on the buoy. All markings on the buoys and buoy lines will be compliant with the regulations and instructions received from staff at the Office of Protected Resources. Additional gear modification as required at the discretion of GARFO. · All vessels will have at least one survey team member onboard the trawl surveys and ventless trap surveys who has completed Northeast Fisheries Observer Program observer training (or another training in protected species identification and safe handling, inclusive of taking genetic samples from Atlantic sturgeon) within the last 5 years. · Follow documentation, incidental reporting, observation, and disentanglement and resuscitation requirements and protocols. Avoiding Protected Species Interactions: · Initiate protected species watches (visual observation) at least 15 minutes prior to sampling by scanning the surrounding waters with the naked eye and range finding binoculars. If protected species are sighted within 1 nm of the station in the 15 minutes before setting the gear, the vessel will transit to a different section of the sampling area. Trawl or gillnet gear should not be deployed if protected species are sighted near the survey vessel. · Vessels must travel 10 knots or less in any Seasonal Management Area (SMA), Slow Zone/Dynamic Management Area (DMA). All vessel operators must check for information regarding mandatory or voluntary ship strike avoidance (SMAs, DMAs, Slow Zones) and daily information regarding North Atlantic right whale sighting locations. Sightings should not be used as the primary or sole means for avoiding right whales, as they only represent locations where right whales were at one point in time.	

38	Sea Turtle/Atlantic Sturgeon Entangle-ment, Handling, Resuscitation, Identification, and Data Collection Guidelines		Any sea turtles or Atlantic sturgeon caught and retrieved in gear used in fisheries surveys must be handled and resuscitated (if unresponsive) according to established protocols provided at-sea conditions are safe for those handling and resuscitating the animal(s) to do so. Specifically: a. Priority must be given to the handling and resuscitation of any sea turtles or sturgeon that are captured in the gear being used. Handling times for these species must be minimized, and if possible, kept to 15 minutes or less to limit the amount of stress placed on the animals. b. All survey vessels must have onboard copies of the sea turtle handling and resuscitation requirements (found at 50 CFR 223.206(d)(1)) before begging any on-water activity (download at: https://media.fisheries.noaa.gov/dam-migration/sea_turtle_handling_and_resuscitation_measures.pdf). These handling and resuscitation procedures must be carried out any time a sea turtle is incidentally captured and brought onboard the vessel during survey activities. c. If any sea turtles that appear injured, sick, or distressed, are caught and retrieved in fisheries survey gear, survey staff must immediately contact the Greater Atlantic Region Marine Animal Hotline at 866-755-6622 for further instructions and guidance on handling the animal, and potential coordination of transfer to a rehabilitation facility. If survey staff are unable to contact the hotline (e.g., due to distance from shore or lack of ability to communicate via phone), the USCG must be contacted via VHF marine radio on Channel 16. If required, hard-shelled sea turtles (i.e., non-leatherbacks) may be held on board for up to 24 hours and managed in accordance with handling instructions provided by the Hotline before transfer to a rehabilitation facility. d. Survey staff must attempt resuscitate any Atlantic sturgeon that are unresponsive or comatose by providing a running source of water over the gills as described in the Sturgeon Resuscitation Guidelines (https://media.fisheries.noaa.gov/dam-migration/sturgeon_ resuscitation_card_06122020_508.pdf). e. If appropriate cold storage facilities are available on the survey vessel, any dead sea turtle or Atlantic sturgeon must be retained on board the survey vessel for transfer to an appropriately permitted partner or facility on shore unless NMFS indicates that storage is unnecessary, or storage is not safe. f. Any live sea turtles or Atlantic sturgeon caught and retrieved in gear used in any fisheries survey must ultimately be released according to established protocols including safety considerations. If any survey gear is lost, all reasonable efforts that do not compromise human safety will be undertaken to recover the gear. All lost gear will be reported to NMFS (nmfs.gar.incidental- take@noaa.gov) and BSEE (TIMSWeb submission and protectedspecies@bsee.gov) within 24 hours of the documented time of missing or lost gear. This report will include information on any markings on the gear and any efforts undertaken or planned to recover the gear. The Lessee must ensure any mooring systems used must be designed to prevent potential entanglement or entrainment of listed species, and in the unlikely event that entanglement does occur, ensure proper reporting of entanglement events according to the measures specified below:	C, O&M, D

			· The Lessee must ensure that any buoys attached to the seafloor use the best available mooring systems. Buoys, lines (chains, cables, or coated rope systems), swivels, shackles, and anchor designs must prevent any potential entanglement of listed species while ensuring the safety and integrity of the structure or device. · All mooring lines and ancillary attachment lines must use one or more of the following measures to reduce entanglement risk: shortest practicable line length, rubber sleeves, weak- links, chains, cables, or similar equipment types that prevent lines from looping, wrapping, or entrapping protected species. · Any equipment must be attached by a line within a rubber sleeve for rigidity. The length of the line must be as short as necessary to meet its intended purpose. · During all buoy deployment and retrieval operations, buoys should be lowered and raised slowly to minimize risk to listed species and benthic habitat. Additionally, PSOs or trained project personnel (if PSOs are not required) should monitor for listed species in the area prior to and during deployment and retrieval and work should be stopped if listed species are observed within 500 meters of the vessel to minimize entanglement risk. · If a live or dead marine protected species becomes entangled, operators must immediately contact the applicable stranding network coordinator using the reporting contact details (see BA-12) and provide any on-water assistance requested · All buoys must be properly labeled with owner and contact information.	
39	Minimize Risk During Buoy Deployment, Operations, and Retrieval		Any mooring systems used during survey activities prevent any potential entanglement or entrainment of listed species, and in the unlikely event that entanglement does occur, ensure proper reporting of entanglement events according to the measures specified below. 1. Ensure that any buoys attached to the seafloor use the best available mooring systems. Buoys, lines (chains, cables, or coated rope systems), swivels, shackles, and anchor designs must prevent any potential entanglement of listed species while ensuring the safety and integrity of the structure or device. 2. All mooring lines and ancillary attachment lines must use one or more of the following measures to reduce entanglement risk: shortest practicable line length, rubber sleeves, weak-links, chains, cables or similar equipment types that prevent lines from looping, wrapping, or entrapping protected species. 3. Any equipment must be attached by a line within a rubber sleeve for rigidity. The length of the line must be as short as necessary to meet its intended purpose. 4. During all buoy deployment and retrieval operations, buoys should be lowered and raised slowly to minimize risk to listed species and benthic habitat. Additionally, PSOs or trained project personnel (if PSOs are not required) should monitor for listed species in the area prior to and during deployment and retrieval and work should be stopped if listed species are observed within 500 m of the vessel to minimize entanglement risk. 5. If a live or dead marine protected species becomes entangled, you must immediately contact the applicable NMFS stranding coordinator using the reporting contact details (see Reporting Requirements section) and provide any on-water assistance requested.	C, O&M, D

			6. All buoys must be properly labeled with owner and contact information.	

Threatened and Endangered Species Mitigation and Monitoring Conditions for SouthCoast Wind Project Data Collection Activities

Data collection activities must meet the following minimum requirements specified below, except when complying with these requirements would put the safety of the vessel or crew at risk.

Avoid Live Bottom Features

1. All vessel anchoring and any seafloor-sampling activities (i.e., drilling or boring for geotechnical surveys) are restricted from seafloor areas with consolidated seabed features . All vessel anchoring and seafloor sampling must also occur at least 150 m from any known locations of threatened or endangered coral species. All sensitive live bottom habitats (eelgrass, cold-water corals, etc.) should be avoided as practicable. All vessels in coastal waters will operate in a manner to minimize propeller wash and seafloor disturbance and transiting vessels should follow deep-water routes (e.g., marked channels), as practicable, to reduce disturbance to sturgeon and sawfish habitat.

Avoid Activities that Could Affect Early Life Stages of Atlantic Sturgeon

1. No geotechnical or bottom disturbing activities will take place during the spawning/rearing season within freshwater reaches of rivers where Atlantic or shortnose sturgeon spawning occurs. Any survey plan that includes geotechnical or other benthic sampling activities in freshwater reaches (salinity 0-0.5 ppt) of such rivers will identify a time of year restriction that will avoid such activities during the time of year when Atlantic sturgeon spawning and rearing of early life stages occurs in that river.

Clearance Zones

1. For situational awareness a Clearance Zone extending at least (500 m in all directions) must be established around all vessels operating sources <180 kHz.

a. The Clearance Zone must be monitored by approved third-party PSOs at all times and any observed listed species must be recorded (see reporting requirements below).

b. For monitoring around the autonomous surface vessel (ASV) where remote PSO monitoring must occur from the mother vessel, a dual thermal/HD camera must be installed on the mother vessel facing forward and angled in a direction so as to provide a field of view ahead of the vessel and around the ASV. PSOs must be able to monitor the real-time output of the camera on hand-held computer tablets. Images from the cameras must be able to be captured and reviewed to assist in verifying species identification. A monitor must also be installed in the bridge displaying the real-time images from the thermal/HD camera installed on the front of the ASV itself, providing a further forward view of the craft. In addition, night-vision goggles with thermal clip-ons and a handheld spotlight must be provided and used such that PSOs can focus observations in any direction around the mother vessel and/or the ASV.

2. To minimize exposure to noise that could be disturbing, Shutdown Zone(s) (500 m for North Atlantic right whales and 100 m for other ESA-listed whales visible at the surface) must be established around the sources operating at <180 kHz being towed from the vessel.

a. The Shutdown Zone(s) must be monitored by third-party PSOs at all times when noise-producing equipment (<180 kHz) is being operated and all observed listed species must be recorded (see reporting requirements below).

b. If an ESA-listed species is detected within or entering the respective Shutdown Zone, any noise-producing equipment operating below 180 kHz must be shut off until the minimum separation distance from the source is re-established (500 m for North Atlantic right whales and

100 m for other ESA-listed species, including other ESA-listed marine mammals) and the measures in (5) are carried out.

i. A PSO must notify the survey crew that a shutdown of all active boomer, sparker, and bubble gun acoustic sources below 180 kHz is immediately required. The vessel operator and crew must comply immediately with any call for a shutdown by the PSO. Any disagreement or discussion must occur only after shutdown.

c. If the Shutdown Zone(s) cannot be adequately monitored for ESA-listed species presence (i.e., a PSO determines conditions, including at night or other low-visibility conditions, are such that listed species cannot be reliably sighted within the Shutdown Zone(s), no equipment operating at <180 kHz can be deployed until such time that the Shutdown Zone(s) can be reliably monitored.

3. Before any noise-producing survey equipment (operating at <180 kHz) is deployed, the Clearance Zone (500 m for all listed species) must be monitored for 30 minutes of pre-clearance observation.

a. If any ESA-listed species is observed within the Clearance Zone during the 30-minute pre-clearance period, the 30-minute clock must be paused. If the PSO confirms the animal has exited the zone and headed away from the survey vessel, the 30-minute clock that was paused may resume. The pre-clearance clock will reset to 30 minutes if the animal dives or visual contact is otherwise lost.

4. When technically feasible, a “ramp up” of the electromechanical survey equipment must occur at the start or re-start of geophysical survey activities. A ramp up must begin with the power of the smallest acoustic equipment for the geophysical survey at its lowest power output. When technically feasible the power will then be gradually turned up and other acoustic sources added in a way such that the source level would increase gradually.

5. Following a shutdown for any reason, ramp up of the equipment may begin immediately only if: (a) the shutdown is less than 30 minutes, (b) visual monitoring of the Shutdown Zone(s) continued throughout the shutdown, (c) the animal(s) causing the shutdown was visually followed and confirmed by PSOs to be outside of the Shutdown Zone(s) (500 m for North Atlantic right whales and 100 m for other ESA listed species, including other ESA-listed marine mammals) and heading away from the vessel, and (d) the Shutdown Zone(s) remains clear of all listed species. If all (a, b, c, and d) the conditions are not met, the Clearance Zone (500 m for all listed species) must be monitored for 30 minutes of pre-clearance observation before noise-producing equipment can be turned back on.

6. In order for geophysical surveys to be conducted at night or during low-visibility conditions, PSOs must be able to effectively monitor the Clearance and Shutdown Zone(s). No may occur if the Clearance and Shutdown Zone(s) cannot be reliably monitored for the presence of ESA-listed species to ensure avoidance of injury to those species.

a. An Alternative Monitoring Plan (AMP) must be submitted to BOEM (or the federal agency authorizing, funding, or permitting the survey) detailing the monitoring methodology that will be used during nighttime and low-visibility conditions and an explanation of how it will be effective at ensuring that the Shutdown Zone(s) can be maintained during nighttime and low-visibility survey operations. The plan must be submitted 60 days before survey operations are set to begin.

b. The plan must include technologies that have the technical feasibility to detect all ESA-listed whales out to 500 m and sea turtles to 100 m.

c. PSOs should be trained and experienced with the proposed alternative monitoring technology.

d. The AMP must describe how calibration will be performed, for example, by including observations of known objects at set distances and under various lighting conditions. This calibration should be performed during mobilization and periodically throughout the survey operation.

e. PSOs shall make nighttime observations from a platform with no visual barriers, due to the potential for the reflectivity from bridge windows or other structures to interfere with the use of the night vision optics.

7. To minimize risk to North Atlantic right whales, no surveys may occur in Cape Cod Bay from January 1 - May 15 of any year (in an area beginning at 42°04′56.5″ N-070°12′00.0″ W; thence north to 42°12′00.0″ N-070°12′00.0″ W; thence due west to charted mean high water line; thence along charted mean high water within Cape Cod Bay back to beginning point).

8. At times when multiple survey vessels are operating within a lease area, adjacent lease areas, or exploratory cable routes, a minimum separation distance (to be determined on a survey specific basis, dependent on equipment being used) must be maintained between survey vessels to ensure that sound sources do not overlap.

9. To minimize disturbance to the Northwest Atlantic Ocean DPS of loggerhead sea turtles, a voluntary pause in sparker operation should be implemented for all vessels operating in nearshore critical habitat for loggerhead sea turtles. These conditions apply to critical habitat boundaries for nearshore reproductive habitats LOGG N-3 through LOGG N-16 (79 FR 39855) from April 1 to September 30. Following pre-clearance procedures, if any loggerhead or other unidentified sea turtles is observed within a 100 m Clearance Zone during a survey, sparker operation should be paused by turning off the sparker until the sea turtle is beyond 100 m of the survey vessel. If the animal dives or visual contact is otherwise lost, sparker operation may resume after a minimum 2-minute pause following the last sighting of the animal.

10. Any visual observations of listed species by crew or project personnel must be communicated to PSOs on-duty.

11. During good conditions (e.g., daylight hours; Beaufort scale 3 or less) when survey equipment is not operating, to the maximum extent practicable, PSOs must conduct observations for protected species for comparison of sighting rates and behavior with and without use of active geophysical survey equipment. Any observed listed species must be recorded regardless of any mitigation actions required.

Minimize Vessel Interactions with Listed Species

All vessels associated with survey activities (transiting [i.e., travelling between a port and the survey site] or actively surveying) must comply with the vessel strike avoidance measures specified below. The only exception is when the safety of the vessel or crew necessitates deviation from these requirements. If any such incidents occur, they must be reported as outlined below under Reporting Requirements (PDC 8). The Vessel Strike Avoidance Zone is defined as 500 m or greater from any sighted ESA-listed species or other unidentified large marine mammal.

1. Vessel captain and crew must maintain a vigilant watch for all protected species and slow down, stop their vessel, or alter course, as appropriate and regardless of vessel size, to avoid striking any listed species. The presence of a single individual at the surface may indicate the presence of submerged animals in the vicinity; therefore, precautionary measures should always be exercised. If pinnipeds or small delphinids of the following genera: Delphinus,

Lagenorhynchus, Stenella, and Tursiops are visually detected approaching the vessel (i.e., to bow ride) or towed equipment, vessel strike avoidance and shutdown is not required.

2. Anytime a survey vessel is underway (transiting or surveying), the vessel must maintain a 500 m minimum separation distance and a PSO must monitor a Vessel Strike Avoidance Zone (500 m or greater from any sighted ESA-listed species or other unidentified large marine mammal visible at the surface) to ensure detection of that animal in time to take necessary measures to avoid striking the animal. If the survey vessel does not require a PSO for the type of survey equipment used, a trained crew lookout may be used (see #3). For monitoring around the autonomous surface vessels, regardless of the equipment it may be operating, a dual thermal/HD camera must be installed on the mother vessel facing forward and angled in a direction so as to provide a field of view ahead of the vessel and around the ASV. A dedicated operator must be able to monitor the real-time output of the camera on hand-held computer tablets. Images from the cameras must be able to be captured and reviewed to assist in verifying species identification. A monitor must also be installed in the bridge displaying the real-time images from the thermal/HD camera installed on the front of the ASV itself, providing a further forward view of the craft.

a. Survey plans must include identification of vessel strike avoidance measures, including procedures for equipment shut down and retrieval, communication between PSOs/crew lookouts, equipment operators, and the captain, and other measures necessary to avoid vessel strike while maintaining vessel and crew safety. If any circumstances are anticipated that may preclude the implementation of this PDC, they must be clearly identified in the survey plan and alternative procedures outlined in the plan to ensure minimum distances are maintained and vessel strikes can be avoided.

b. All vessel crew members must be briefed in the identification of protected species that may occur in the survey area and in regulations and best practices for avoiding vessel collisions. Reference materials must be available aboard all project vessels for identification of listed species. The expectation and process for reporting of protected species sighted during surveys must be clearly communicated and posted in highly visible locations aboard all project vessels, so that there is an expectation for reporting to the designated vessel contact (such as the lookout or the vessel captain), as well as a communication channel and process for crew members to do so.

c. The Vessel Strike Avoidance Zone(s) are a minimum and must be maintained around all surface vessels at all times.

d. If a large whale is identified within 500 m of the forward path of any vessel, the vessel operator must steer a course away from the whale at 10 knots (18.5 km/hr) or less until the 500 m minimum separation distance has been established. Vessels may also shift to idle if feasible.

e. If a large whale is sighted within 200 m of the forward path of a vessel, the vessel operator must reduce speed and shift the engine to neutral. Engines must not be engaged until the whale has moved outside of the vessel’s path and beyond 500 m. If stationary, the vessel must not engage engines until the large whale has moved beyond 500 m.

f. If a sea turtle or manta ray is sighted within 100 m of the operating vessel’s forward path, the vessel operator must slow down to 4 knots (unless unsafe to do so) and steer away as possible. The vessel may resume normal operations once the vessel has passed the individual.

g. During times of year when sea turtles are known to occur in the survey area, vessels must avoid transiting through areas of visible jellyfish aggregations or floating vegetation (e.g., sargassum lines or mats). In the event that operational safety prevents avoidance of such areas, vessels must slow to 4 knots while transiting through such areas.

h. Vessels operating in water depths with less than 4 ft. clearance between the vessel and the bottom should maintain speeds no greater than 4 knots to minimize vessel strike risk to sturgeon and sawfish.

2. To monitor the Vessel Strike Avoidance Zone, a PSO (or crew lookout if PSOs are not required) must be posted during all times a vessel is underway (transiting or surveying) to monitor for listed species in all directions.

a. Visual observers monitoring the vessel strike avoidance zone can be either PSOs or crew members (if PSOs are not required). If the trained lookout is a vessel crew member, this must be their designated role and primary responsibility while the vessel is transiting. Any designated crew lookouts must receive training on protected species identification, vessel strike minimization procedures, how and when to communicate with the vessel captain, and reporting requirements. All observations must be recorded per reporting requirements.

b. Regardless of monitoring duties, all crew members responsible for navigation duties must receive site-specific training on ESA-listed species sighting/reporting and vessel strike avoidance measures.

3. Regardless of vessel size, vessel operators must reduce vessel speed to 10 knots (18.5 mph) or less while operating in any Seasonal Management Area (SMA), Dynamic Management Area (DMA)/Slow Zones triggered by visual detection of North Atlantic right whales. The only exception to this requirement is for vessels operating in areas within a DMA/visually triggered Slow Zone where it is not reasonable to expect the presence of North Atlantic right whales (e.g. Long Island Sound, shallow harbors). Reducing vessel speed to 10 knots or less while operating in Slow Zones triggered by acoustic detections of North Atlantic right whales is encouraged.

4. Vessels underway must not divert their course to approach any listed species.

5. All vessel operators must check for information regarding mandatory or voluntary ship strike avoidance (SMAs, DMAs, Slow Zones) and daily information regarding North Atlantic right whale sighting locations. These media may include, but are not limited to: NOAA weather radio, U.S. Coast Guard NAVTEX and channel 16 broadcasts, Notices to Mariners, the Whale Alert app , or WhaleMap website.

a. North Atlantic right whale Sighting Advisory System info can be accessed at: https://apps-nefsc.fisheries.noaa.gov/psb/surveys/MapperiframeWithText.html

b. Information about active SMAs, DMAs, and Slow Zones can be accessed at: https://www.fisheries.noaa.gov/national/endangered-species-conservation/reducing-vessel-strikes-north-atlantic-right-whales

Protected Species Observers

Qualified third-party PSOs to observe Clearance and Shutdown Zones must be used as outlined in the conditions above.

1. BMPs:All PSOs must have completed an approved PSO training program and must receive NMFS approval to act as a PSO for geophysical surveys. Documentation of NMFS approval for geophysical survey activities in the Atlantic and copies of the most recent training certificates of individual PSOs' successful completion of a commercial PSO training course with an overall examination score of 80% or greater must be provided upon request. Instructions and application requirements to become a NMFS-approved PSO can be found at:

http://www.fisheries.noaa.gov/national/endangered-species-conservation/protected-species-observers

2. In situations where third-party party PSOs are not required, crew members serving as lookouts must receive training on protected species identification, vessel strike minimization procedures, how and when to communicate with the vessel captain, and reporting requirements.

3. PSOs deployed for geophysical survey activities must be employed by a third-party observer provider. While the vessel is underway, they must have no other tasks than to conduct observational effort, record data, and communicate with and instruct relevant vessel crew to the presence of listed species and associated mitigation requirements. PSOs on duty must be clearly listed on daily data logs for each shift.

a. Non-third-party observers may be approved by NMFS on a case-by-case basis for limited, specific duties in support of approved, third-party PSOs.

4. A minimum of one PSO (assuming condition 5 is met) must be on duty observing for listed species at all times that noise-producing equipment <180 kHz is operating, or the survey vessel is actively transiting during daylight hours (i.e. from 30 minutes prior to sunrise and through 30 minutes following sunset). Two PSOs must be on duty during nighttime operations. A PSO schedule showing that the number of PSOs used is sufficient to effectively monitor the affected area for the project (e.g., surveys) and record the required data must be included. PSOs must not be on watch for more than 4 consecutive hours, with at least a 2-hour break after a 4-hour watch. PSOs must not be on active duty observing for more than 12 hours in any 24-hour period.

5. Visual monitoring must occur from the most appropriate vantage point on the associated operational platform that allows for 360-degree visual coverage around the vessel. If 360-degree visual coverage is not possible from a single vantage point, multiple PSOs must be on watch to ensure such coverage.

6. Suitable equipment must be available to each PSO to adequately observe the full extent of the Clearance and Shutdown Zones during all vessel operations and meet all reporting requirements.

a. Visual observations must be conducted using binoculars and the naked eye while free from distractions and in a consistent, systematic, and diligent manner.

b. Rangefinders (at least one per PSO, plus backups) or reticle binoculars (e.g., 7 x 50) of appropriate quality (at least one per PSO, plus backups) to estimate distances to listed species located in proximity to the vessel and Clearance and Shutdown Zone(s).

c. Digital full frame cameras with a telephoto lens that is at least 300 mm or equivalent. The camera or lens should also have an image stabilization system. Used to record sightings and verify species identification whenever possible.

d. A laptop or tablet to collect and record data electronically.

e. Global Positioning Units (GPS) if data collection/reporting software does not have built-in positioning functionality.

f. PSO data must be collected in accordance with standard data reporting, software tools, and electronic data submission standards approved by BOEM and NMFS for the particular activity.

g. Any other tools deemed necessary to adequately perform PSO tasks.

Reporting Requirements

To ensure compliance and evaluate effectiveness of mitigation measures, regular reporting of survey activities and information on listed species will be required as follows.

BMPs:

1. Data from all PSO observations must be recorded based on standard PSO collection and reporting requirements. PSOs must use standardized electronic data forms to record data. The following information must be reported electronically in a format approved by BOEM and NMFS:

Visual Effort:

a. Vessel name
b. Dates of departures and returns to port with port name;
c. Lease number;
d. PSO names and affiliations;
e. PSO ID (if applicable);
f. PSO location on vessel;
g. Height of observation deck above water surface (in meters);
h. Visual monitoring equipment used;
i. Dates and times (Greenwich Mean Time) of survey on/off effort and times corresponding with PSO on/off effort;
j. Vessel location (latitude/longitude, decimal degrees) when survey effort begins and ends; vessel location at beginning and end of visual PSO duty shifts; recorded at 30 second intervals if obtainable from data collection software, otherwise at practical regular interval;
k. Vessel heading and speed at beginning and end of visual PSO duty shifts and upon any change;
l. Water depth (if obtainable from data collection software) (in meters);
m. Environmental conditions while on visual survey (at beginning and end of PSO shift and whenever conditions change significantly), including wind speed and direction, Beaufort scale, Beaufort wind force, swell height (in meters), swell angle, precipitation, cloud cover, sun glare, and overall visibility;
n. Factors that may be contributing to impaired observations during each PSO shift change or as needed as environmental conditions change (e.g., vessel traffic, equipment malfunctions);
o. Survey activity information, such as type of survey equipment in operation, acoustic source power output while in operation, and any other notes of significance (i.e., pre-clearance survey, ramp-up, shutdown, end of operations, etc.);

Visual Sighting (all Visual Effort fields plus):

a. Watch status (sighting made by PSO on/off effort, opportunistic, crew, alternate vessel/platform);
b. Vessel/survey activity at time of sighting;
c. PSO/PSO ID who sighted the animal;
d. Time of sighting;
e. Initial detection method;
f. Sightings cue;
g. Vessel location at time of sighting (decimal degrees);
h. Direction of vessel's travel (compass direction);
i. Direction of animal's travel relative to the vessel;
j. Identification of the animal (e.g., genus/species, lowest possible taxonomic level, or unidentified); also note the composition of the group if there is a mix of species;

k. Species reliability;
l. Distance and direction to animal at initial and final detection, and closest point of approach of animal to vessel;
m. Distance method;
n. Group size; Estimated number of animals (high/low/best);
o. Estimated number of animals by cohort (adults, yearlings, juveniles, calves, group composition, etc.);
p. Description (as many distinguishing features as possible of each individual seen, including length, shape, color, pattern, scars or markings, shape and size of dorsal fin, shape of head, and blow characteristics);
q. Detailed behavior observations (e.g., number of blows, number of surfaces, breaching, spyhopping, diving, feeding, traveling; as explicit and detailed as possible; note any observed changes in behavior);
r. Mitigation Action; Description of any actions implemented in response to the sighting (e.g., delays, shutdown, ramp-up, speed or course alteration, etc.) and time and location of the action.
s. Behavioral observation to mitigation;
t. Equipment operating during sighting;
u. Source depth (in meters);
v. Source frequency;
w. Animal's closest point of approach and/or closest distance from the center point of the acoustic source;
x. Time entered shutdown zone;
y. Time exited shutdown zone;
z. Time in shutdown zone;

2. Photos/VideoThe project proponent must submit a final monitoring report to BOEM, BSEE and NMFS (to renewable_reporting@boem.gov, TIMSWeb and email to protectedspecies@bsee.gov, and nmfs.gar.incidental-take@noaa.gov) within 90 days after completion of survey activities. The report must fully document the methods and monitoring protocols, summarizes the survey activities and the data recorded during monitoring, estimates of the number of listed species that may have been taken during survey activities, describes, assesses and compares the effectiveness of monitoring and mitigation measures. PSO sightings and effort data and trackline data in Excel spreadsheet format must also be provided with the final monitoring report.

3. Reporting sightings of North Atlantic right whales:

a. If a North Atlantic right whale is observed at any time by a PSO or project personnel during surveys or vessel transit, sightings must be reported within two hours of occurrence when practicable and no later than 24 hours after occurrence. In the event of a sighting of a right whale that is dead, injured, or entangled, efforts must be made to make such reports as quickly as possible to the appropriate regional NOAA stranding hotline (from Maine-Virginia report sightings to 866-755-6622, and from North Carolina-Florida to 877-942-5343). Right whale sightings in any location may also be reported to the U.S. Coast Guard via channel 16 and through the WhaleAlert App (http://www.whalealert.org/).

b. Further information on reporting a right whale sighting can be found at: https://appsnefsc.fisheries.noaa.gov/psb/surveys/documents/20120919_Report_a_Right_Whale.pdf

4. In the event of a vessel strike of a protected species by any survey vessel, the project proponent must immediately report the incident to BOEM (renewable_reporting@boem.gov), BSEE TIMSWeb and email to protectedspecies@bsee.gov, and NMFS (nmfs.gar.incidental-take@noaa.gov) and for marine mammals to the NOAA stranding hotline: from Maine-Virginia, report to 866- 755-6622, and from North Carolina-Florida to 877-942-5343 and for sea turtles from Maine-Virginia, report to 866-755-6622, and from North Caroline-Florida to 844-732-8785. The report must include the following information:

a. Name, telephone, and email or the person providing the report;

b. The vessel name;

c. The Lease Number;

d. Time, date, and location (latitude/longitude) of the incident;

e. Species identification (if known) or description of the animal(s) involved;

f. Vessel's speed during and leading up to the incident;

g. Vessel's course/heading and what operations were being conducted (if applicable);

h. Status of all sound sources in use;

i. Description of avoidance measures/requirements that were in place at the time of the strike and what measures were taken, if any, to avoid strike;

j. Environmental conditions (wave height, wind speed, light, cloud cover, weather, water depth);

k. Estimated size and length of animal that was struck;

l. Description of the behavior of the species immediately preceding and following the strike;

m. If available, description of the presence and behavior of any other protected species immediately preceding the strike;

n. Disposition of the animal (e.g., dead, injured but alive, injured and moving, blood or tissue observed in the water, last sighted direction of travel, status unknown, disappeared); and

o. To the extent practicable, photographs or video footage of the animal(s).

5. Sightings of any injured or dead listed species must be immediately reported, regardless of whether the injury or death is related to survey operations, to BOEM (renewable_reporting@boem.gov), BSEE TIMSWeb and email to protectedspecies@bsee.gov, NMFS (nmfs.gar.incidental-take@noaa.gov), and the appropriate regional NOAA stranding hotline (from Maine-Virginia report sightings to 866-755-6622, and from North Carolina-Florida to 877-942-5343 for marine mammals and 844-732-8785 for sea turtles). If the project proponent's activity is responsible for the injury or death, they must ensure that the vessel assist in any salvage effort as requested by NMFS. When reporting sightings of injured or dead listed species, the following information must be included:

a. Time, date, and location (latitude/longitude) of the first discovery (and updated location information if known and applicable);

b. Species identification (if known) or description of the animal(s) involved;

c. Condition of the animal(s) (including carcass condition if the animal is dead);

d. Observed behaviors of the animal(s), if alive;

e. If available, photographs or video footage of the animal(s); and

f. General circumstances under which the animal was discovered.

6. Reporting and Contact Information:

a. Dead and/or Injured Protected Species:

i. NMFS Greater Atlantic Region's Stranding Hotline: 866-755-6622 \

ii. NMFS Southeast Region’s Stranding Hotline: 877-942-5343 (marine mammals), 844-732-8785 (sea turtles)

b. Injurious Takes of Endangered and Threatened Species:

i. NMFS Greater Atlantic Regional Office, Protected Resources Division (nmfs.gar.incidental-take@noaa.gov)

ii. BOEM Environment Branch for Renewable Energy, Phone: 703- 787-1340, Email: renewable_reporting@boem.gov

iii. BSEE through TIMSWeb and email to protectedspecies@bsee.gov

APPENDIX B.

Mitigation, Monitoring, and Reporting Requirements Included in the Proposed MMPA ITA (89 FR 53708).

MITIGATION REQUIREMENTS

When conducting the specified activities identified in §§ 217.330(c), SouthCoast Wind must implement the following mitigation measures contained in this section and any LOA issued under §§ 217.336 or 217.337 of this subpart. These mitigation measures include, but are not limited to:

(a) *General Conditions*. SouthCoast Wind must comply with the following general measures:

(1) A copy of any issued LOA must be in the possession of SouthCoast Wind and its designees, all vessel operators, visual protected species observers (PSOs), passive acoustic monitoring (PAM) operators, pile driver operators, and any other relevant designees operating under the authority of the issued LOA;

(2) SouthCoast Wind must conduct training for construction supervisors, construction crews, and the PSO and PAM team prior to the start of all construction activities and when new personnel join the work in order to explain responsibilities, communication procedures, marine mammal monitoring and reporting protocols, and operational procedures. A description of the training program must be provided to NMFS at least 60 days prior to the initial training before in-water activities begin. Confirmation of all required training must be documented on a training course log sheet and reported to NMFS Office of Protected Resources prior to initiating project activities;

(3) SouthCoast Wind is required to use available sources of information on North Atlantic right whale presence to aid in monitoring efforts. These include daily monitoring of the Right Whale Sighting Advisory System, consulting of the WhaleAlert app, and monitoring of the Coast Guard's VHF Channel 16 to receive notifications of marine mammal sightings and information associated with any Dynamic Management Areas (DMA) and Slow Zones;

(4) Any marine mammal observation by project personnel must be immediately communicated to any on-duty PSOs and PAM operator(s). Any large whale observation or acoustic detection by any project personnel must be conveyed to all vessel captains;

(5) If an individual from a species for which authorization has not been granted or a species for which authorization has been granted but the authorized take number has been met is observed entering or within the relevant clearance zone prior to beginning a specified activity, the activity must be delayed. If an activity is ongoing and an individual from a species for which authorization has not been granted or a species for which authorization has been granted but the authorized take number has been met is observed entering or within the relevant shutdown zone, the activity must be shut down (*i.e.*, cease) immediately unless shutdown would result in imminent risk of injury or loss of life to an individual, pile refusal, or pile instability. The activity must not commence or resume until the animal(s) has been confirmed to have left the clearance or shutdown zones and is on a path away from the applicable zone or after 30 minutes for all baleen whale species and sperm whales, and 15 minutes for all other species;

(6) In the event that a large whale is sighted or acoustically detected that cannot be confirmed as a non-North Atlantic right whale, it must be treated as if it were a North Atlantic right whale for purposes of mitigation;

(7) For in-water construction heavy machinery activities listed in section 1(a), if a marine

mammal is detected within or about to enter 10 meters (m) (32.8 feet (ft)) of equipment, SouthCoast Wind must cease operations until the marine mammal has moved more than 10 m on a path away from the activity to avoid direct interaction with equipment;

(8) All vessels must be equipped with a properly installed, operational Automatic Identification System (AIS) device prior to vessel use and SouthCoast Wind must report all Maritime Mobile Service Identify (MMSI) numbers to NMFS Office of Protected Resources;

(9) By accepting a LOA, SouthCoast Wind consents to on-site observation and inspections by Federal agency personnel (including NOAA personnel) during activities described in this subpart, for the purposes of evaluating the implementation and effectiveness of measures contained within this subpart and the LOA; and

(10) It is prohibited to assault, harm, harass (including sexually harass), oppose, impede, intimidate, impair, or in any way influence or interfere with a PSO, PAM operator, or vessel crew member acting as an observer, or attempt the same. This prohibition includes, but is not limited to, any action that interferes with an observer's responsibilities or that creates an intimidating, hostile, or offensive environment. Personnel may report any violations to the NMFS Office of Law Enforcement.

(b) *Vessel strike avoidance measures*: SouthCoast Wind must comply with the following vessel strike avoidance measures while in the specific geographic region unless a deviation is necessary to maintain safe maneuvering speed and justified because the vessel is in an area where oceanographic, hydrographic, and/or meteorological conditions severely restrict the maneuverability of the vessel; an emergency situation presents a threat to the health, safety, life of a person; or when a vessel is actively engaged in emergency rescue or response duties, including vessel-in distress or environmental crisis response. An emergency is defined as a serious event that occurs without warning and requires immediate action to avert, control, or remedy harm.

(1) Prior to the start of the Project’s activities involving vessels, all vessel personnel must receive a protected species training that covers, at a minimum, identification of marine mammals that have the potential to occur in the specified geographical region; detection and observation methods in both good weather conditions (*i.e.*, clear visibility, low winds, low sea states) and bad weather conditions (*i.e.*, fog, high winds, high sea states, with glare); sighting communication protocols; all vessel strike avoidance mitigation requirements; and information and resources available to the project personnel regarding the applicability of Federal laws and regulations for protected species. This training must be repeated for any new vessel personnel who join the project. Confirmation of the vessel personnels’ training and understanding of the LOA requirements must be documented on a training course log sheet and reported to NMFS within 30 days of completion of training, prior to personnel joining vessel operations;

(2) All vessel operators and dedicated visual observers must maintain a vigilant watch for all marine mammals and slow down, stop their vessel, or alter course to avoid striking any marine mammal;

(3) All transiting vessels, operating at any speed must have a dedicated visual observer on duty at all times to monitor for marine mammals within a 180 degrees (°) direction of the forward path of the vessel (90° port to 90° starboard) located at an appropriate vantage point for ensuring vessels are maintaining required separation distances. Dedicated visual observers may be PSOs or crew members, but crew members responsible for these duties must be provided sufficient training by SouthCoast Wind to distinguish marine mammals from other phenomena and must be able to identify a marine mammal as a North Atlantic right whale, other large whale

(defined in this context as sperm whales or baleen whales other than North Atlantic right whales), or other marine mammals. Dedicated visual observers must be equipped with alternative monitoring technology (*e.g.*, night vision devices, infrared cameras) for periods of low visibility (*e.g.*, darkness, rain, fog, *etc*.). The dedicated visual observer must not have any other duties while observing and must receive prior training on protected species detection and identification, vessel strike avoidance procedures, how and when to communicate with the vessel captain, and reporting requirements in this subpart;

(4) All vessel operators and dedicated visual observers must continuously monitor US Coast Guard VHF Channel 16 at the onset of transiting through the duration of transit. At the onset of transiting and at least once every 4 hours, vessel operators and/or trained crew member(s) must also monitor the project's Situational Awareness System, (if applicable), WhaleAlert, and relevant NOAA information systems such as the Right Whale Sighting Advisory System (RWSAS) for the presence of North Atlantic right whales;

(5) Prior to transit, vessel operators must check for information regarding the establishment of Seasonal and Dynamic Management Areas, Slow Zones, and any information regarding North Atlantic right whale sighting locations;

(6) All vessel operators must abide by vessel speed regulations (50 CFR 224.105). Nothing in this subpart exempts vessels from any other applicable marine mammal speed or approach regulations;

(7) All vessels, regardless of size, must immediately reduce speed to 10 knots (18.5 km/hr) or less for at least 24 hours when a North Atlantic right whale is sighted at any distance by any project related personnel or acoustically detected by any project-related PAM system. Each subsequent observation or acoustic detection in the Project area must trigger an additional 24-hour period. If a North Atlantic right whale is reported via any of the monitoring systems (described in paragraph (b)(4) of this section) within 10 km of a transiting vessel(s), that vessel must operate at 10 knots (18.5 km/hr) or less for 24 hours following the reported detection.

(8) In the event that a DMA or Slow Zone is established that overlaps with an area where a project-associated vessel is operating, that vessel, regardless of size, must transit that area at 10 knots (18.5 km/hr) or less;

(9) Between November 1st and April 30th, all vessels, regardless of size, must operate at 10 knots (18.5 km/hr) or less in the specified geographical region, except for vessels while transiting in Narragansett Bay or Long Island Sound;

(10) All vessels, regardless of size, must immediately reduce speed to 10 knots (18.5 km/hr) or less when any large whale, (other than a North Atlantic right whale), mother/calf pairs, or large assemblages of non-delphinid cetaceans are observed within 500 m (0.31 mi) of a transiting vessel;

(11) If a vessel is traveling at any speed greater than 10 knots (18.5 km/hr) (*i.e.*, no speed restrictions are enacted) in the transit corridor (defined as from a port to the Lease Area or return), in addition to the required dedicated visual observer, SouthCoast Wind must monitor the transit corridor in real-time with PAM prior to and during transits. If a North Atlantic right whale is detected via visual observation or PAM within or approaching the transit corridor, all vessels in the transit corridor must travel at 10 knots (18.5 km/hr) or less for 24 hours following the detection. Each subsequent detection shall trigger a 24-hour reset. A slowdown in the transit corridor expires when there has been no further North Atlantic right whale visual or acoustic detection in the transit corridor in the past 24 hours;

(12) All vessels must maintain a minimum separation distance of 500 m from North Atlantic right whales. If underway, all vessels must steer a course away from any sighted North Atlantic right whale at 10 knots (18.5 km/hr) or less such that the 500-m minimum separation distance requirement is not violated. If a North Atlantic right whale is sighted within 500 m of an underway vessel, that vessel must turn away from the whale(s), reduce speed and shift the engine to neutral. Engines must not be engaged until the whale has moved outside of the vessel's path and beyond 500 m;

(13) All vessels must maintain a minimum separation distance of 100 m (328 ft) from sperm whales and non-North Atlantic right whale baleen whales. If one of these species is sighted within 100 m (328 ft) of an underway vessel, the vessel must turn away from the whale(s), reduce speed, and shift the engine(s) to neutral. Engines must not be engaged until the whale has moved outside of the vessel's path and beyond 100 m (328 ft);

(14) All vessels must maintain a minimum separation distance of 50 m (164 ft) from all delphinid cetaceans and pinnipeds with an exception made for those that approach the vessel (*e.g.*, bow-riding dolphins). If a delphinid cetacean or pinniped is sighted within 50 m (164 ft) of a transiting vessel, that vessel must turn away from the animal(s), reduce speed, and shift the engine to neutral, with an exception made for those that approach the vessel (*e.g.*, bow-riding dolphins). Engines must not be engaged until the animal(s) has moved outside of the vessel's path and beyond 50 m (164 ft);

(15) All vessels underway must not divert or alter course to approach any marine mammal; and

(16) SouthCoast Wind must submit a Marine Mammal Vessel Strike Avoidance Plan 180 days prior to the planned start of vessel activity that provides details on all relevant mitigation and monitoring measures for marine mammals, vessel speeds and transit protocols from all planned ports, vessel-based observer protocols for transiting vessels, communication and reporting plans, and proposed alternative monitoring equipment in varying weather conditions, darkness, sea states, and in consideration of the use of artificial lighting. If SouthCoast Wind plans to implement PAM in any transit corridor to allow vessel transit above 10 knots (18.5 km/hr) the plan must describe how PAM, in combination with visual observations, will be conducted. If a plan is not submitted and approved by NMFS prior to vessel operations, all project vessels must travel at speeds of 10 knots (18.5 km/hr) or less. SouthCoast Wind must comply with any approved Marine Mammal Vessel Strike Avoidance Plan.

(c) *Wind turbine generator (WTG) and offshore substation platform (OSP) foundation installation.* The following requirements apply to vibratory and impact pile driving activities associated with the installation of WTG and OSP foundations:

(1) Foundation pile driving activities must not occur January 1 through May 15 throughout the Lease Area. From October 16 through May 31, impact and vibratory pile driving must not occur at locations in SouthCoast's Lease Area within the North Atlantic right whale Enhanced Mitigation Area (NARW EMA; defined as the area within 20 km (12.4 mi) from the 30-m (98-ft) isobath on the west side of Nantucket Shoals);

(2) Outside of the NARW EMA, foundation pile driving must not be planned for December; however, it may occur only if necessary to complete pile driving within a given year and with prior approval by NMFS and implementation of enhanced mitigation and monitoring (see 217.334(c)(7), 217.334(c)(13)). SouthCoast Wind must notify NMFS in writing by September 1 of that year if circumstances are expected to necessitate pile driving in December;

(3) In the NARW EMA, SouthCoast must install foundations as quickly as possible and sequence them from the northeast corner of the Lease Area to the southwest corner such that foundation installation in positions closest to Nantucket Shoals are completed during the period of lowest North Atlantic right whale occurrence in that area;

(4) Monopiles must be no larger than a tapered 9/16-m diameter monopile design and pin piles must be no larger than 4.5-m diameter design. The minimum amount of hammer energy necessary to effectively and safely install and maintain the integrity of the piles must be used. Impact hammer energies must not exceed 6,600 kilojoules (kJ) for monopile installations and 3,500 kJ for pin pile installations;

(5) SouthCoast must not initiate pile driving earlier than 1 hour after civil sunrise or later than 1.5 hours prior to civil sunset unless SouthCoast submits and NMFS approves a Nighttime Pile Driving Monitoring Plan that demonstrates the efficacy of their low-visibility visual monitoring technology (e.g., night vision devices, Infrared (IR) cameras) to effectively monitor the mitigation zones in low visibility conditions. SouthCoast must submit this plan or plans (if separate Daytime Reduced Visibility and Nighttime Monitoring Plans are prepared) at least 180 calendar days before foundation installation is planned to begin. SouthCoast must submit a separate Plan describing daytime reduced visibility monitoring if the information in the Nighttime Monitoring Plan does not sufficiently apply to all low-visibility monitoring;

(6) SouthCoast Wind must utilize a soft-start protocol at the beginning of foundation installation for each impact pile driving event and at any time following a cessation of impact pile driving for 30 minutes or longer;

(7) SouthCoast Wind must deploy, at minimum, a double bubble curtain during all foundation pile driving;

(i) The double bubble curtain must distribute air bubbles using an air flow rate of at least 0.5 m^3/(min*m). The double bubble curtain must surround 100 percent of the piling perimeter throughout the full depth of the water column. In the unforeseen event of a single compressor malfunction, the offshore personnel operating the bubble curtain(s) must make adjustments to the air supply and operating pressure such that the maximum possible sound attenuation performance of the bubble curtain(s) is achieved;

(ii) The lowest bubble ring must be in contact with the seafloor for the full circumference of the ring, and the weights attached to the bottom ring must ensure 100-percent seafloor contact.

(iii) No parts of the ring or other objects may prevent full seafloor contact with a bubble curtain ring.

(iv) SouthCoast Wind must inspect and carry out maintenance on the noise attenuation systems prior to every pile driving event and prepare and submit a Noise Attenuation System (NAS) inspection/performance report. For piles for which Thorough SFV (T-SFV) (as required by 217.334(c)(19)) is carried out, this report must be submitted as soon as it is available, but no later than when the interim T-SFV report is submitted for the respective pile. Performance reports for all subsequent piles must be submitted with the weekly pile driving reports. All reports must be submitted by email to *pr.itp.monitoringreports@noaa.gov*.

(8) SouthCoast Wind must utilize PSOs. Each monitoring platform must have at least three on-duty PSOs. PSOs must be located on the pile driving vessel as well as on a minimum of three PSO-dedicated vessels inside the NARW EMA June 1 through July 31 and outside the NARW EMA June 1 through November 30, and a minimum of four PSO-dedicated vessels within the NARW EMA from August 1 through October 15 and throughout the Lease Area from May 16-31 and December 1-31 (if pile driving in December is deemed necessary and approved

by NMFS);

(9) Concurrent with visual monitoring, SouthCoast Wind must utilize PAM operator(s), as described in a NMFS-approved PAM Plan, who must conduct acoustic monitoring of marine mammals for 60 minutes before, during, and 30 minutes after completion of impact and vibratory pile driving for each pile. PAM operators must immediately communicate all detections of marine mammals to the Lead PSO, including any determination regarding species identification, distance, and bearing and the degree of confidence in the determination;

(10) To increase situational awareness prior to pile driving, the PAM operator must review PAM data collected within the 24 hours prior to a pile installation;

(11) The PAM system must be able to detect marine mammal vocalizations, maximize baleen whale detections, and detect North Atlantic right whale vocalizations up to a distance of 10 km (6.2 mi) and 15 km (9.3mi) during pin pile and monopile installation, respectively. NMFS recognizes that detectability of each species' vocalizations will vary based on vocalization characteristics (e.g., frequency content, source level), acoustic propagation conditions, and competing noise sources), such that other marine mammal species (*e.g.*, harbor porpoise) may not be detected at 10 km (6.2 mi) or 15 km (9.3 mi);

(12) SouthCoast Wind must submit a Passive Acoustic Monitoring Plan (PAM Plan) to NMFS Office of Protected Resources for review and approval at least 180 days prior to the planned start of foundation installation activities and abide by the Plan if approved;

(13) SouthCoast Wind must establish clearance and shutdown zones, which must be measured using the radial distance from the pile being driven. All clearance zones must be confirmed to be free of marine mammals for 30 minutes immediately prior to the beginning of soft-start procedures or vibratory pile driving. If a marine mammal (other than a North Atlantic right whale) is detected within or about to enter the applicable clearance zones during this 30-minute time period, vibratory and impact pile driving must be delayed until the animal has been visually observed exiting the clearance zone or until a specific time period has elapsed with no further sightings. The specific time periods are 30 minutes for all baleen whale species and sperm whales and 15 minutes for all other species;

(14) For North Atlantic right whales, any visual observation by a PSO at any distance, or acoustic detection within the 10-km (6.2-mi) (pin pile) and 15-km (9.32-mi) (monopile) PAM clearance and shutdown zones must trigger a delay to the commencement or shutdown (if already begun) of pile driving. For any acoustic detection within the North Atlantic right whale PAM clearance and shutdown zones or sighting of 1 or 2 North Atlantic right whales, SouthCoast Wind must delay commencement of or shutdown pile driving for 24 hours. For any sighting of 3 or more North Atlantic right whales, SouthCoast Wind must delay commencement of or shutdown pile driving for 48 hours. Prior to beginning clearance at the pile driving location after these periods, SouthCoast must conduct a vessel-based survey to visually clear the 10-km (6.2-mi) zone, if installing pin piles that day, or 15-km (9.32-mi) zone, if installing monopiles.

(15) If visibility decreases such that the entire clearance zone is not visible, at minimum, PSOs must be able to visually clear (*i.e.*, confirm no marine mammals are present) the minimum visibility zone. The entire minimum visibility zone must be visible (*i.e.*, not obscured by dark, rain, fog, *etc*.) for the full 60 minutes immediately prior to commencing impact and vibratory pile driving;

(16) If a marine mammal is detected (visually or acoustically) entering or within the respective shutdown zone after pile driving has begun, the PSO or PAM operator must call for a shutdown of pile driving and SouthCoast Wind must stop pile driving immediately, unless

shutdown is not practicable due to imminent risk of injury or loss of life to an individual or risk of damage to a vessel that creates risk of injury or loss of life for individuals, or the lead engineer determines there is risk of pile refusal or pile instability. If pile driving is not shut down due to one of these situations, SouthCoast Wind must reduce hammer energy to the lowest level practicable to maintain stability;

(17) If pile driving has been shut down due to the presence of a marine mammal other than a North Atlantic right whale, pile driving must not restart until either the marine mammal(s) has voluntarily left the species-specific clearance zone and has been visually or acoustically confirmed beyond that clearance zone, or, when specific time periods have elapsed with no further sightings or acoustic detections. The specific time periods are 30 minutes for all non-North Atlantic right whale baleen whale species and sperm whales and 15 minutes for all other species. In cases where these criteria are not met, pile driving may restart only if necessary to maintain pile stability at which time SouthCoast Wind must use the lowest hammer energy practicable to maintain stability;

(18) SouthCoast Wind must submit a Pile Driving Marine Mammal Monitoring Plan to NMFS Office of Protected Resources for review and approval at least 180 days prior to planned start of foundation pile driving and abide by the Plan if approved. SouthCoast Wind must obtain both NMFS Office of Protected Resources and NMFS Greater Atlantic Regional Fisheries Office Protected Resources Division’s concurrence with this Plan prior to the start of any pile driving;

(19) SouthCoast Wind must perform T-SFV measurements during installation of, at minimum, the first three WTG monopile foundations, first four WTG pin piles, and all OSP jacket foundation pin piles;

(i) T-SFV measurements must continue until at least three consecutive monopiles or four consecutive pin piles demonstrate noise levels are at or below those modeled, assuming 10 decibels (dB) of attenuation. Subsequent T-SFV measurements are also required should larger piles be installed or if additional monopiles or pin piles are driven that may produce louder sound fields than those previously measured (*e.g.*, from higher hammer energy, greater number of strikes);

(ii) T-SFV measurements must be made at a minimum of four distances from the pile(s) being driven along a single transect in the direction of lowest transmission loss (*i.e.*, projected lowest transmission loss coefficient), including, but not limited to, 750 m (2,460 ft) and three additional ranges selected such that measurement of modeled Level A harassment and Level B harassment isopleths are accurate, feasible, and avoids extrapolation (*i.e.*, recorder spacing is approximately logarithmic and significant gaps near expected isopleths are avoided). At least one additional measurement at an azimuth 90 degrees from the transect array at 750 m (2,460 ft) must be made. At each location, there must be a near bottom and mid-water column hydrophone (acoustic recorder);

(iii) If any of the T-SFV results indicate that distances to harassment isopleths were exceeded, then SouthCoast Wind must implement additional measures for all subsequent foundation installations to ensure the measured distances to the Level A harassment and Level B harassment threshold isopleths do not exceed those modeled assuming 10 dB attenuation. SouthCoast Wind must also increase clearance, shutdown, and/or Level B harassment zone sizes to those identified by NMFS until T-SFV measurements on at least three additional monopiles or four pin piles demonstrate distances to harassment threshold isopleths meet or are less than those modeled assuming 10-dB of attenuation. For every 1,500 m (4,900 ft) that a marine mammal clearance or shutdown zone is expanded, additional PSOs must be deployed from additional platforms/vessels to ensure adequate and complete monitoring of the expanded clearance and/or shutdown zone(s), with each PSO responsible for scanning no more than 120 degrees (°) out to a radius no greater than 1,500 m (4,900 ft). SouthCoast Wind must optimize the sound attenuation systems (*e.g.*, ensure hose maintenance, pressure testing, *etc.*) to, at least, meet noise levels modeled, assuming 10-dB attenuation, within three monopiles or four pin piles, or else foundation installation activities must cease until NMFS and SouthCoast Wind can evaluate potential reasons for louder than anticipated noise levels. Alternatively, if SouthCoast determines T-SFV results demonstrate noise levels are within those modeled assuming 10 dB attenuation, SouthCoast may proceed to the next pile after submitting the interim report to NMFS;

(20) SouthCoast Wind also must conduct abbreviated SFV, using at least one acoustic recorder (consisting of a bottom and mid-water column hydrophone) for every foundation for which T-SFV monitoring is not conducted. All abbreviated SFV data must be included in weekly reports. Any indications that distances to the identified Level A harassment and Level B harassment thresholds for marine mammals may be exceeded based on this abbreviated monitoring must be addressed by SouthCoast Wind in the weekly report, including an explanation of factors that contributed to the exceedance and corrective actions that were taken to avoid exceedance on subsequent piles. SouthCoast Wind must meet with NMFS within two business days of SouthCoast Wind's submission of a report that includes an exceedance to discuss if any additional action is necessary;

(21) The SFV measurement systems must have a sensitivity for the expected sound levels from pile driving received at the nominal ranges throughout the installation of the pile. The frequency range of SFV measurement systems must cover the range of at least 20 hertz (Hz) to 20 kilohertz (kHz). The SFV measurement systems must be designed to have omnidirectional sensitivity so that the broadband received level of all pile driving exceeds the system noise floor by at least 10 dB. The dynamic range of the SFV measurement system must be sufficient such that at each location, and the signals avoid poor signal-to-noise ratios for low amplitude signals and avoid clipping, nonlinearity, and saturation for high amplitude signals;

(22) SouthCoast must ensure that all hydrophones used in pile installation SFV measurements systems have undergone a full system, traceable laboratory calibration conforming to International Electrotechnical Commission (IEC) 60565, or an equivalent standard procedure from a factory or accredited source, at a date not to exceed 2 years before deployment, to guarantee each hydrophone receives accurate sound levels. Additional *in situ* calibration checks using a pistonphone must be performed before and after each hydrophone deployment. If the measurement system employs filters via hardware or software (*e.g.*, high-pass, low-pass, *etc.*), which is not already accounted for by the calibration, the filter performance (*i.e.*, the filter's frequency response) must be known, reported, and the data corrected for the filter's effect before analysis;

(23) SouthCoast Wind must be prepared with additional equipment (*e.g.*, hydrophones, recording devices, hydrophone calibrators, cables, batteries), which exceeds the amount of equipment necessary to perform the measurements, such that technical issues can be mitigated before measurement;

(24) If any of the SFV measurements from any pile indicate that the distance to any isopleth of concern is greater than those modeled assuming 10-dB attenuation, before the next pile is installed, SouthCoast Wind must implement the following measures, as applicable: identify and propose for review and concurrence; additional, modified, and/or alternative noise attenuation measures or operational changes that present a reasonable likelihood of reducing

sound levels to the modeled distances; provide a written explanation to NMFS Office of Protected Resources supporting that determination, and request concurrence to proceed; and, following NMFS Office of Protected Resources' concurrence, deploy those additional measures on any subsequent piles that are installed (*e.g.*, if threshold distances are exceeded on pile 1, then additional measures must be deployed before installing pile 2);

(25) If SFV measurements indicate that ranges to isopleths corresponding to the Level A harassment and Level B harassment thresholds are less than the ranges predicted by modeling (assuming 10-dB attenuation) for 3 consecutive monopiles or 4 consecutive pin piles, SouthCoast Wind may submit a request to NMFS Office of Protected Resources for a modification of the mitigation zones for non-North Atlantic right whale species. Mitigation zones for North Atlantic right whales cannot be decreased;

(26) SouthCoast must measure background noise (*i.e*., noise absent pile driving) for 30 minutes before and after each pile installation;

(27) SouthCoast must conduct SFV measurements upon commencement of turbine operations to estimate turbine operational source levels, in accordance with a NMFS-approved Foundation Installation Pile Driving SFV Plan. SFV must be conducted in the same manner as previously described in paragraph (13) of this section, with adjustments to measurement distances, number of hydrophones, and hydrophone sensitivities being made, as necessary; and

(28) SouthCoast Wind must submit a SFV Plan for thorough and abbreviated SFV for foundation installation and WTG operations to NMFS Office of Protected Resources for review and approval at least 180 days prior to planned start of foundation installation activities and abide by the Plan if approved. Pile driving may not occur until NMFS provides SouthCoast concurrence that implementation of the SFV Plan meets the requirements in the LOA.

(d) *UXO/MEC detonation*.The following requirements apply to Unexploded Ordnances and Munitions and Explosives of Concern (UXO/MEC) detonation:

(1) Upon encountering a UXO/MEC, SouthCoast Wind can only resort to high-order removal (*i.e.*, detonation) if all other means of removal are impracticable (*i.e.*, As Low As Reasonably Practicable (ALARP) risk mitigation procedure)) and this determination must be documented and submitted to NMFS;

(2) UXO/MEC detonations must not occur from December 1 through April 30;

(3) UXO/MEC detonations must only occur during daylight hours (1 hour after civil sunrise through 1.5 hours prior to civil sunset);

(4) No more than one detonation can occur within a 24-hour period. No more than 10 detonations may occur throughout the effective period of these regulations;

(5) SouthCoast Wind must deploy, at minimum, a double bubble curtain during all UXO/MEC detonations and comply with the following requirements related to noise abatement:

(i) The bubble curtain(s) must distribute air bubbles using an air flow rate of at least 0.5 m^3/(min*m). The bubble curtain(s) must surround 100 percent of the UXO/MEC detonation perimeter throughout the full depth of the water column. In the unforeseen event of a single compressor malfunction, the offshore personnel operating the bubble curtain(s) must make adjustments to the air supply and operating pressure such that the maximum possible noise attenuation performance of the bubble curtain(s) is achieved;

(ii) The lowest bubble ring must be in contact with the seafloor for the full circumference of the ring, and the weights attached to the bottom ring must ensure 100-percent seafloor contact;

(iii) No parts of the ring or other objects may prevent full seafloor contact;

(iv) Construction contractors must train personnel in the proper balancing of airflow to the ring. Construction contractors must submit an inspection/performance report for approval by SouthCoast Wind within 72 hours following the performance test. SouthCoast Wind must then submit that report to NMFS Office of Protected Resources;

(v) Corrections to the bubble ring(s) to meet the performance standards in this paragraph (5) must occur prior to UXO/MEC detonations. If SouthCoast Wind uses a noise mitigation device in addition to the bubble curtain, SouthCoast Wind must maintain similar quality control measures as described in this paragraph (5); and

(vi) SouthCoast Wind must inspect and carry out maintenance on the noise attenuation system prior to every UXO/MEC detonation and prepare and submit a Noise Attenuation System (NAS) inspection/performance report as soon as it is available and prior to the UXO/MEC detonation to NMFS Office of Protected Resources.

(6) SouthCoast Wind must conduct SFV during all UXO/MEC detonations at a minimum of three locations (at two water depths at each location) from each detonation in a direction toward deeper water in accordance with the following requirements:

(i) SouthCoast Wind must empirically determine source levels (peak and cumulative sound exposure level), the ranges to the isopleths corresponding to the Level A harassment and Level B harassment threshold isopleths in meters and the transmission loss coefficient(s). SouthCoast Wind may estimate ranges to the Level A harassment and Level B harassment isopleths by extrapolating from *in situ* measurements conducted at several distances from the detonation location monitored;

(ii) The SFV measurement systems must have a sensitivity for the expected sound levels from detonations received at the nominal ranges throughout the detonation. The dynamic range of the SFV measurement systems must be sufficient such that at each location, the signals avoid poor signal-to-noise ratios for low amplitude signals and the signals avoid clipping, nonlinearity, and saturation for high amplitude signals;

(iii) All hydrophones used in UXO/MEC SFV measurements systems are required to have undergone a full system, traceable laboratory calibration conforming to International Electrotechnical Commission (IEC) 60565, or an equivalent standard procedure, from a factory or accredited source to ensure the hydrophone receives accurate sound levels, at a date not to exceed 2 years before deployment. Additional *in-situ* calibration checks using a pistonphone are required to be performed before and after each hydrophone deployment. If the measurement system employs filters via hardware or software (*e.g.,* high-pass, low-pass, *etc.*), which is not already accounted for by the calibration, the filter performance (*i.e*., the filter's frequency response) must be known, reported, and the data corrected before analysis;

(iv) SouthCoast Wind must be prepared with additional equipment (hydrophones, recording devices, hydrophone calibrators, cables, batteries, *etc.*), which exceeds the amount of equipment necessary to perform the measurements, such that technical issues can be mitigated before measurement;

(v) SouthCoast Wind must submit SFV reports within 72 hours after each UXO/MEC detonation;

(vi) If acoustic field measurements collected during UXO/MEC detonation indicate ranges to the isopleths, corresponding to Level A harassment and Level B harassment thresholds, are greater than the ranges predicted by modeling (assuming 10 dB attenuation), SouthCoast Wind must implement additional noise mitigation measures prior to the next UXO/MEC detonation. SouthCoast Wind must provide written notification to NMFS Office of Protected

Resources of the changes planned for the next detonation within 24 hours of implementation. Subsequent UXO/MEC detonation activities must not occur until NMFS and SouthCoast Wind can evaluate the situation and ensure future detonations will not exceed noise levels modeled assuming 10-dB attenuation; and

(vii) SouthCoast Wind must optimize the noise attenuation systems (*e.g.*, ensure hose maintenance, pressure testing) to, at least, meet noise levels modeled, assuming 10-dB attenuation.

(7) SouthCoast Wind must establish and implement clearance zones for UXO/MEC detonation using both visual and acoustic monitoring;

(8) At least three on-duty PSOs must be stationed on each monitoring platform and be monitoring for 60 minutes prior to, during, and 30 minutes after each UXO/MEC detonation. The number of platforms is contingent upon the size of the UXO/MEC detonation to be identified in SouthCoast's UXO/MEC Detonation Marine Mammal Monitoring Plan and must be sufficient such that PSOs are able to visually clear the entire clearance zone. Concurrently, at least one PAM operator must be actively monitoring for marine mammals with PAM 60 minutes before, during, and 30 minutes after detonation; and

(9) All clearance zones must be confirmed to be acoustically free of marine mammals for 30 minutes prior to a detonation. If a marine mammal is observed entering or within the relevant clearance zone prior to the initiation of a detonation, detonation must be delayed and must not begin until either the marine mammal(s) has voluntarily left the specific clearance zones and have been visually and acoustically confirmed beyond that clearance zone, or, when specific time periods have elapsed with no further sightings or acoustic detections. The specific time periods are 30 minutes for all baleen whale species and sperm whales and 15 minutes for all other species.

(e) *HRG surveys*. The following requirements apply to HRG surveys operating sub-bottom profilers (SBPs) (*e.g.*, boomers, sparkers, and Compressed High Intensity Radiated Pulse (CHIRPS)) (hereinafter referred to as "acoustic sources"):

(1) SouthCoast Wind must establish and implement clearance and shutdown zones for HRG surveys using visual monitoring. These zones must be measured using the radial distance(s) from the acoustic source(s) currently in use;

(2) SouthCoast must utilize PSO(s), as described in § 217.335(e). Visual monitoring must begin no less than 30 minutes prior to initiation of specified acoustic sources and must continue until 30 minutes after use of specified acoustic sources ceases. Any PSO on duty has the authority to delay the start of survey operations or shutdown operations if a marine mammal is detected within the applicable zones. When delay or shutdown is instructed by a PSO, the mitigative action must be taken and any dispute resolved only following deactivation;

(3) Prior to starting the survey and after receiving confirmation from the PSOs that the clearance zone is clear of any marine mammals, SouthCoast Wind is required to ramp-up acoustic sources to half power for 5 minutes prior to commencing full power, unless the equipment operates on a binary on/off switch (in which case ramp-up is not required). Any ramp-up of acoustic sources may only commence when visual clearance zones are fully visible (*e.g.*, not obscured by darkness, rain, fog, *etc*.) and clear of marine mammals, as determined by the Lead PSO, for at least 30 minutes immediately prior to the initiation of survey activities using a specified acoustic source. Ramp-ups must be scheduled so as to minimize the time spent with the source activated;

(4) Prior to a ramp-up procedure starting, the acoustic source operator must notify the

Lead PSO of the planned start of ramp-up. The notification time must not be less than 60 minutes prior to the planned ramp-up or activation in order to allow the PSO(s) time to monitor the clearance zone(s) for 30 minutes prior to the initiation of ramp-up or activation (pre-start clearance). During this 30-minute clearance period, the entire applicable clearance zones must be visible;

(5) A PSO conducting clearance observations must be notified again immediately prior to reinitiating ramp-up procedures and the operator must receive confirmation from the PSO to proceed;

(6) If a marine mammal is observed within a clearance zone during the 30 minute clearance period, ramp-up or acoustic surveys may not begin until the animal(s) has been observed voluntarily exiting its respective clearance zone or until a specific time period has elapsed with no further sighting. The specific time periods are 30 minutes for all baleen whale species and sperm whales and 15 minutes for all other species;

(7) In any case when the clearance process has begun in conditions with good visibility, including via the use of night vision/reduced visibility monitoring equipment (infrared (IR)/thermal camera), and the Lead PSO has determined that the clearance zones are clear of marine mammals, survey operations may commence (*i.e.*, no delay is required) despite periods of inclement weather and/or loss of daylight. Ramp-up may occur at times of poor visibility, including nighttime, if required visual monitoring has occurred with no detections of marine mammals in the 30 minutes prior to beginning ramp-up;

(8) Once the survey has commenced, SouthCoast Wind must shut down acoustic sources if a marine mammal enters a respective shutdown zone. In cases when the shutdown zones become obscured for brief periods (less than 30 minutes) due to inclement weather, survey operations would be allowed to continue (*i.e.*, no shutdown is required) so long as no marine mammals have been detected. The shutdown requirement does not apply to small delphinids of the following genera: *Delphinus, Stenella, Lagenorhynchus,* and *Tursiops*. If there is uncertainty regarding the identification of a marine mammal species (*i.e.*, whether the observed marine mammal belongs to one of the delphinid genera for which shutdown is waived), the PSOs must use their best professional judgment in making the decision to call for a shutdown. Shutdown is required if a delphinid that belongs to a genus other than those specified in this paragraph of this section is detected in the shutdown zone;

(9) If an acoustic source has been shut down due to the presence of a marine mammal, the use of an acoustic source may not commence or resume until the animal(s) has been confirmed to have left the Level B harassment zone or until a full 30 minutes for all baleen whale species and sperm whales and 15 minutes for all other species have elapsed with no further sighting. If an acoustic source is shut down for reasons other than mitigation (*e.g.*, mechanical difficulty) for less than 30 minutes, it may be activated again without ramp-up only if PSOs have maintained constant observation and no additional detections of any marine mammal occurred within the respective shutdown zones. If an acoustic source is shut down for a period longer than 30 minutes, then all clearance and ramp-up procedures must be initiated;

(10) If multiple HRG vessels are operating concurrently, any observations of marine mammals must be communicated to PSOs on all nearby survey vessels; and

(11) Should an autonomous survey vehicle (ASV) be used during HRG surveys, the ASV must remain with 800 m (2,635 ft) of the primary vessel while conducting survey operations; two PSOs must be stationed on the mother vessel at the best vantage points to monitor the clearance and shutdown zones around the ASV; at least one PSO must monitor the output of a thermal

high-definition camera installed on the mother vessel to monitor the field-of-view around the ASV using a hand-held tablet, and during periods of reduced visibility (*e.g.*, darkness, rain, or fog), PSOs must use night-vision goggles with thermal clip-ons and a hand-held spotlight to monitor the clearance and shutdown zones around the ASV.

(f) *Fisheries Monitoring Surveys*. The following measures apply during fisheries monitoring surveys and must be implemented by SouthCoast Wind:

(1) Marine mammal monitoring must be conducted within 1 nmi (1.85 km) from the planned survey location by the trained captain and/or a member of the scientific crew for 15 minutes prior to deploying gear, throughout gear deployment and use, and for 15 minutes after haul back;

(2) All captains and crew conducting fishery surveys must be trained in marine mammal detection and identification;

(3) Gear must not be deployed if there is a risk of interaction with marine mammals. Gear must not be deployed until a minimum of 15 consecutive minutes have elapsed during which no marine mammal sightings within 1 nmi (1,852 m) of the sampling station have occurred;

(4) If marine mammals are sighted within 1 nm of the planned location (*i.e.*, station) within the 15 minutes prior to gear deployment, then SouthCoast Wind must move the vessel away from the marine mammal to a different section of the sampling area. If, after moving on, marine mammals are still visible from the vessel, SouthCoast Wind must move again to an area visibly clear of marine mammals or skip the station;

(5) If a marine mammal is at risk of interacting with deployed gear or set, all gear must be immediately removed from the water. If marine mammals are sighted before the gear is fully removed from the water, the vessel must slow its speed and maneuver the vessel away from the animals to minimize potential interactions with the observed animal;

(6) Survey gear must be deployed as soon as possible once the vessel arrives on station and after fulfilling the requirements in (g)(1) and (g)(3);

(7) SouthCoast Wind must maintain visual marine mammal monitoring effort during the entire period of time that gear is in the water (*i.e.*, throughout gear deployment, fishing, and retrieval). If marine mammals are sighted before the gear is fully removed from the water, SouthCoast Wind will take the most appropriate action to avoid marine mammal interaction;

(8) All fisheries monitoring gear must be fully cleaned and repaired (if damaged) before each use/deployment;

(9) SouthCoast Wind’s fixed gear must comply with the Atlantic Large Whale Take Reduction Plan regulations at 50 CFR 229.32 during fisheries monitoring surveys;

(10) Trawl tows must be limited to a maximum of 20 minute trawl-time and trawl tows must not exceed at a speed of 3.0 knots (3.5 mph);

(11) All gear must be emptied as close to the deck/sorting area and as quickly as possible after retrieval;

(12) During trawl surveys, vessel or scientific crew must open the cod end of the trawl net close to the deck in order to avoid injury to animals that may be caught in the gear;

(13) All fishery survey-related lines must include the breaking strength of all lines being less than 1,700 pounds (lbs; 771 kilograms (kg)). This may be accomplished by using whole buoy line that has a breaking strength of 1,700 lbs (771 kg); or buoy line with weak inserts that result in line having an overall breaking strength of 1,700 lbs (771 kg);

(14) During any survey that uses vertical lines, buoy lines must be weighted and must not float at the surface of the water. All groundlines must be composed entirely of sinking lines.

Buoy lines must utilize weak links. Weak links must break cleanly leaving behind the bitter end of the line. The bitter end of the line must be free of any knots when the weak link breaks. Splices are not considered to be knots. The attachment of buoys, toggles, or other floatation devices to groundlines is prohibited;

(15) All in-water survey gear, including buoys, must be properly labeled with the scientific permit number or identification as SouthCoast Wind's research gear. All labels and markings on the gear, buoys, and buoy lines must also be compliant with the applicable regulations, and all buoy markings must comply with instructions received by the NOAA Greater Atlantic Regional Fisheries Office Protected Resources Division;

(16) All survey gear must be removed from the water whenever not in active survey use (*i.e.*, no wet storage);

(17) All reasonable efforts that do not compromise human safety must be undertaken to recover gear; and

(18) Any lost gear associated with the fishery surveys must be reported to the NOAA Greater Atlantic Regional Fisheries Office Protected Resources Division within 24 hours.

§ 217.335 Monitoring and Reporting Requirements

SouthCoast Wind must implement the following monitoring and reporting requirements when conducting the specified activities (see § 217.330(c)):

(a) Protected species observer (PSO) and passive acoustic monitoring (PAM) operator qualifications: SouthCoast Wind must implement the following measures applicable to PSOs and PAM operators:

(1) SouthCoast Wind must use NMFS-approved PSOs and PAM operators that are employed by a third-party observer provider. PSOs and PAM operators must have no tasks other than to conduct observational effort, collect data, and communicate with and instruct relevant personnel regarding the presence of marine mammals and mitigation requirements;

(2) All PSOs and PAM operators must have successfully attained a bachelor's degree from an accredited college or university with a major in one of the natural sciences. The educational requirements may be waived if the PSO or PAM operator has acquired the relevant experience and skills (see § 217.335(a)(3)) for visually and/or acoustically detecting marine mammals in a range of environmental conditions (*e.g.*, sea state, visibility) within zone sizes equivalent to the clearance and shutdown zones required by these regulations. Requests for such a waiver must be submitted to NMFS Office of Protected Resources prior to or when SouthCoast Wind requests PSO and PAM operator approvals and must include written justification describing alternative experience. Alternate experience that may be considered includes, but is not limited to, conducting academic, commercial, or government-sponsored marine mammal visual and/or acoustic surveys or previous work experience as a PSO/PAM operator. All PSO's and PAM operators should demonstrate good standing and consistently good performance of all assigned duties;

(3) PSOs must have visual acuity in both eyes (with correction of vision being permissible) sufficient enough to discern moving targets on the water's surface with the ability to estimate the target size and distance (binocular use is allowable); ability to conduct field observations and collect data according to the assigned protocols, writing skills sufficient to document observations and the ability to communicate orally by radio or in-person with project personnel to provide real-time information on marine mammals observed in the area;

(4) All PSOs must be trained to identify northwestern Atlantic Ocean marine mammal species and behaviors and be able to conduct field observations and collect data according to

assigned protocols. Additionally, PSOs must have the ability to work with all required and relevant software and equipment necessary during observations described in paragraphs (b)(2) and (b)(3) of this section;

(5) All PSOs and PAM operators must have successfully completed a PSO, PAM, or refresher training course within the last 5 years and obtained a certificate of course completion that must be submitted to NMFS. This requirement is waived for any PSOs and PAM operators that completed a relevant training course more than five years prior to seeking approval but have been working consistently as a PSO or PAM operator within the past five years;

(6) At least one on-duty PSO and PAM operator, where applicable, per platform must be designated as a Lead during each of the specified activities;

(7) PSOs and PAM operators are responsible for obtaining NMFS' approval. NMFS may approve PSOs as conditional or unconditional. An unconditionally approved PSO is one who has completed training within the last 5 years and attained the necessary experience (*i.e.*, demonstrate experience with monitoring for marine mammals at clearance and shutdown zone sizes similar to those produced during the respective activity) or for PSOs and PAM operators who completed training more than five years previously and have worked in the specified role consistently for at least the past 5 years. A conditionally-approved PSO may be one who has completed training in the last 5 years but has not yet attained the requisite field experience. To qualify as a Lead PSO or PAM operator, the person must be unconditionally approved and demonstrate that they have a minimum of 90 days of at-sea experience in the specific role, with the conclusion of the most recent relevant experience not more than 18 months previous to deployment, and must also have experience specifically monitoring baleen whale species;

(7) PSOs for HRG surveys may be unconditionally or conditionally approved. A conditionally approved PSO for HRG surveys must be paired with an unconditionally approved PSO;

(8) PSOs and PAM operators for foundation installation and UXO detonation must be unconditionally approved;

(9) SouthCoast Wind must submit NMFS-approved PSO and PAM operator resumes to NMFS Office of Protected Resources for review and confirmation of their approval for specific roles at least 90 days prior to commencement of the activities requiring PSOs/PAM operators or 30 days prior to when new PSOs/PAM operators are required after activities have commenced. Resumes must include information related to relevant education, experience, and training, including dates, duration (*i.e.*, number of days as a PSO or PAM operator per project), location, and description of each prior PSO or PAM operator experience (*i.e.*, zone sizes monitored, how monitoring supported mitigation; PAM system/software utilized);

(10) For prospective PSOs and PAM operators not previously approved by NMFS or for PSOs and PAM operators whose approval is not current (*i.e*., approval date is more than 5 years prior to the start of monitoring duties), SouthCoast Wind must submit the list of pre-approved PSOs and PAM operators for qualification verification at least 60 days prior to PSO and PAM operator use. Resumes must include information detailed in 217.335(a)(9). Resumes must be accompanied by certificate of completion of a NMFS-approved PSO and/or PAM training/course;

(11) To be approved as a PAM operator, the person must meet the following qualifications: the PAM operator must have completed a PAM Operator training course, and demonstrate prior experience using PAM software, equipment, and real-time acoustic detection systems. They must demonstrate that they have prior experience independently analyzing

archived and/or real-time PAM data to identify and classify baleen whale and other marine mammal vocalizations by species, including North Atlantic right whale and humpback whale vocalizations, and experience with deconfliction of multiple species' vocalizations that are similar and/or received concurrently. PAM operators must be independent observers (*i.e*., not construction personnel), trained to use relevant project-specific PAM software and equipment, and must also be able to test software and hardware functionality prior to beginning real-time monitoring. The PAM operator must be able to identify and classify marine mammal acoustic detections by species in real-time (prioritizing North Atlantic right whales and noting other marine mammals vocalizations, when detected). At a minimum, for each acoustic detection, the PAM operator must be able to categorically determine whether a North Atlantic right whale is detected, possibly detected, or not detected, and notify the Lead PSO of any confirmed or possible detections, including baleen whale detections that cannot be identified to species. If the PAM software is capable of localization of sounds or deriving bearings and distance, the PAM operators must demonstrate experience using this technique;

(12) PSOs may work as PAM operators and vice versa if NMFS approves each individual for both roles; however, they may only perform one role at any one time and must not exceed work time restrictions, which must be tallied cumulatively; and

(13) All PSOs and PAM operators must complete a Permits and Environmental Compliance Plan training that must be held by the Project compliance representative(s) prior to the start of in-water project activities and whenever new PSOs and PAM operators join the marine mammal monitoring team. PSOs and PAM operators must also complete training and orientation with the construction operation to provide for personal safety;

(b) *General PSO and PAM operator requirements*. The following measures apply to PSOs and PAM operators and must be implemented by SouthCoast Wind:

(1) All PSOs must be located at the best vantage point(s) on any platform, as determined by the Lead PSO, in order to collectively obtain 360-degree visual coverage of the entire clearance and shutdown zones around the activity area and as much of the Level B harassment zone as possible. PAM operators may be located on a vessel or remotely on-shore but must have a computer station equipped with a data collection software system and acoustic data analysis software available wherever they are stationed, and data or data products must be streamed in real-time or in near real-time to allow PAM operators to provide assistance to on-duty PSOs in determining if mitigation is required (i.e., delay or shutdown);

(2) PSOs must use high magnification (25x) binoculars, standard handheld (7x) binoculars, and the naked eye to search continuously for marine mammals during visual monitoring. During foundation installation, at least three PSOs on each dedicated PSO vessel must be equipped with functional Big Eye binoculars (*e.g.*, 25 x 150; 2.7 view angle; individual ocular focus; height control). These must be pedestal mounted on the deck at the best vantage point that provides for optimal sea surface observation and PSO safety. PAM operators must use a NMFS-approved PAM system to conduct acoustic monitoring;

(3) During periods of low visibility (*e.g.*, darkness, rain, fog, poor weather conditions, *etc*.), PSOs must use alternative technology (*e.g.*, infrared or thermal cameras) to monitor the mitigation zones;

(4) PSOs and PAM operators must not exceed 4 consecutive watch hours on duty at any time, must have a 2-hour (minimum) break between watches, and must not exceed a combined watch schedule of more than 12 hours in a 24-hour period; and

(5) SouthCoast Wind must ensure that PSOs conduct, as rotation schedules allow,

observations for comparison of sighting rates and behavior with and without use of the specified acoustic sources. Off-effort PSO monitoring must be reflected in the PSO monitoring reports.

(c) *Reporting.* SouthCoast Wind must comply with the following reporting measures:

(1) Prior to initiation of project activities, SouthCoast Wind must demonstrate in a report submitted to NMFS Office of Protected Resources (*pr.itp.monitoringreports@noaa.gov*) that all required training for SouthCoast Wind personnel, including the vessel crews, vessel captains, PSOs, and PAM operators has been completed;

(2) SouthCoast Wind must use a standardized reporting system. All data collected related to the Project must be recorded using industry-standard software that is installed on field laptops and/or tablets. Unless stated otherwise, all reports must be submitted to NMFS Office of Protected Resources (*PR.ITP.MonitoringReports@noaa.gov*), dates must be in MM/DD/YYYY format, and location information must be provided in Decimal Degrees and with the coordinate system information (*e.g.*, NAD83, WGS84);

(3) Full detection data, metadata, and location of recorders (or GPS tracks, if applicable) from all real-time hydrophones used for monitoring during foundation installation and UXO/MEC detonations must be submitted within 90 calendar days following completion of activities requiring PAM for mitigation via the International Organization for Standardization (ISO) standard metadata forms available on the NMFS Passive Acoustic Reporting System website (*https://www.fisheries.noaa.gov/resource/document/passive-acoustic-reportingsystem-templates*). Submit the completed data templates to nmfs.nec.pacmdata@noaa.gov. The full acoustic recordings from real-time systems must also be sent to the National Centers for Environmental Information (NCEI) for archiving within 90 days following completion of activities requiring PAM for mitigation. Submission details can be found at: *https://www.ncei.noaa.gov/products/passive-acoustic-data*;

(4) SouthCoast Wind must compile and submit weekly reports during foundation installation containing, at minimum, the marine mammal monitoring and abbreviated SFV data to NMFS Office of Protected Resources (*pr.itp.monitoringreports@noaa.gov)*. Weekly reports are due on Wednesday for the previous week (Sunday – Saturday);

(5) SouthCoast Wind must compile and submit monthly reports during foundation installation containing, at minimum, data as described in the weekly reports to NMFS Office of Protected Resources (*pr.itp.monitoringreports@noaa.gov)*. Monthly reports are due on the 15th of the month for the previous month;

(6) SouthCoast Wind must submit a draft annual marine mammal monitoring report to NMFS (*PR.ITP.monitoringreports@noaa.gov*) no later than March 31, annually that contains data for all specified activities. The final annual marine mammal monitoring report must be prepared and submitted within 30 calendar days following the receipt of any comments from NMFS on the draft report;

(7) SouthCoast Wind must submit the T-SFV interim report no later than 48 hours after cessation of pile driving for a given foundation installation. In addition to the 48-hour interim reports, SouthCoast Wind must submit a draft annual SFV report to NMFS (*PR.ITP.monitoringreports@noaa.gov*) no later than 90 days after SFV is completed for the year. The final annual SFV report must be prepared and submitted within 30 calendar days (or longer upon approval by NMFS) following the receipt of any comments from NMFS on the draft report;

(8) SouthCoast Wind must submit its draft final 5-year report to NMFS (*PR.ITP.monitoringreports@noaa.gov*) on all visual and acoustic monitoring, including SFV

monitoring, within 90 calendar days of the completion of the specified activities. A 5-year report must be prepared and submitted within 60 calendar days (or longer upon approval by NMFS) following receipt of any NMFS Office of Protected Resources comments on the draft report;

(9) SouthCoast Wind must submit SFV results from UXO/MEC detonation monitoring in a report prior to detonating a subsequent UXO/MEC or within the relevant weekly report, whichever comes first;

(10) SouthCoast must submit bubble curtain performance reports within 48 hours of each bubble curtain deployment;

(11) SouthCoast Wind must provide NMFS Office of Protected Resources with notification of planned UXO/MEC detonation as soon as possible but at least 48 hours prior to the planned detonation unless this 48-hour notification requirement would create delays to the detonation that would result in imminent risk of human life or safety. This notification must include the coordinates of the planned detonation, the estimated charge size, and any other information available on the characteristics of the UXO/MEC;

(13) SouthCoast Wind must submit a report to the NMFS Office of Protected Resources (insert ITP monitoring email) within 24 hours if an exemption to any of the requirements in the regulations and LOA is taken;

(14) SouthCoast Wind must submit reports on all North Atlantic right whale sightings and any dead or entangled marine mammal sightings to NMFS Office of Protected Resources (PR.ITP.MonitoringReports@noaa.gov); and

(15) SouthCoast Wind must report any lost gear associated with the fishery surveys to the NOAA Greater Atlantic Regional Fisheries Office Protected Resources Division (*nmfs.gar.incidentaltake@noaa.gov*) as soon as possible or within 24 hours of the documented time of missing or lost gear.

APPENDIX C.
2021 Site Assessment and Data Collection Programmatic Letter of Concurrence

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
GREATER ATLANTIC REGIONAL FISHERIES OFFICE
55 Great Republic Drive
Gloucester, MA 01930

June 29, 2021

James F. Bennett
Program Manager, Office of Renewable Energy Programs
U.S. Department of the Interior
Bureau of Ocean Energy Management
45600 Woodland Road, VAM-OREP
Sterling, Virginia 20166

Dear Mr. Bennett:

We have completed consultation pursuant to section 7 of the Endangered Species Act (ESA) of 1973, as amended, concerning the effects of certain site assessment and site characterization activities to be carried out to support the siting of offshore wind energy development projects off the U.S. Atlantic coast. The Bureau of Ocean Energy Management (BOEM) is the lead federal agency for this consultation. BOEM's request for consultation included a biological assessment (BA) that was finalized in February 2021 and was supplemented with modified Project Design Criteria (PDC) and supplemental information through June 11, 2021. The activities considered in this consultation may occur in the three Atlantic Renewable Energy Regions (North Atlantic Planning Area, Mid-Atlantic Planning Area, and South Atlantic Planning Area; see Figure 1 in Appendix A) and adjacent coastal waters over the next 10 years (i.e., June 2021 – June 2031). Other action agencies include the U.S. Army Corps of Engineers (USACE), the U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency (EPA), and the National Marine Fisheries Service's (NMFS) Office of Protected Resources (OPR).

ACTION AREA AND PROPOSED ACTIONS

As defined in 50 CFR 402.02, "programmatic consultation is a consultation addressing an agency's multiple actions on a program, region, or other basis. Programmatic consultations allow NMFS to consult on the effects of programmatic actions such as: (1) Multiple similar, frequently occurring, or routine actions expected to be implemented in particular geographic areas; and, (2) A proposed program, plan, policy, or regulation providing a framework for future proposed actions." This programmatic consultation considers category 1--multiple similar, frequently occurring, or routine actions expected to be implemented in particular geographic areas.

The survey activities considered in this consultation are geophysical and geotechnical surveys and the deployment, operation, and retrieval of environmental data collection buoys. These frequent, similar activities are expected to be implemented along the U.S. Atlantic coast in the three Atlantic Renewable Energy Regions (North Atlantic Planning Area, Mid-Atlantic Planning Area, and South Atlantic Planning Area). The meteorological buoys and geophysical and geotechnical surveys are expected to occur to support the potential future siting of offshore wind turbines, cables, and associated offshore facilities such as substations or service platforms.

Action Agencies
As noted above, the activities considered here may be authorized, funded, or carried out by BOEM, the DOE, the EPA, the USACE, and NMFS. The roles of these action agencies are described here.

BOEM
The Outer Continental Shelf Lands Act (OCSLA), as amended, mandates the Secretary of the Interior (Secretary), through BOEM, to manage the siting and development of the Outer Continental Shelf (OCS) for renewable energy facilities. BOEM is delegated the responsibility for overseeing offshore renewable energy development in Federal waters (30 C.F.R. Part 585). Through these regulations, BOEM oversees responsible offshore renewable energy development, including the issuance of leases for offshore wind development. This consultation considers the effects of certain data collection activities (geophysical and geotechnical surveys and deployment of meteorological buoys) that may be undertaken to support offshore wind development. BOEM regulations require that a lessee provide the results of shallow hazard, geological, geotechnical, biological, and archaeological surveys with its Site Assessment Plan and Construction and Operations Plan (see 30 C.F.R. 585.610(b) and 30 C.F.R. 585.626(a)). BOEM also funds data collection projects, such as seafloor mapping through the Environmental Studies Program (ESP). The activities considered here may or may not occur in association with a BOEM lease. This consultation does not obviate the need for an appropriate consultation to occur on lease issuance or the approval of a Site Assessment Plan or Construction and Operations Plan.

DOE
The DOE's Office of Energy Efficiency and Renewable Energy (EERE) provides federal funding (financial assistance) in support of renewable energy technologies. EERE's Wind Energy Technologies Office invests in energy science research and development activities that enable the innovations needed to advance U.S. wind systems, reduce the cost of electricity, and accelerate the deployment of wind power, including offshore wind. EERE's Water Power Technologies Office enables research, development, and testing of emerging technologies to advance marine energy. DOE's financial assistance in support of renewable energy projects could have consequences for listed species in federal or state waters. Data collection activities that may be supported by DOE and are considered in this programmatic consultation include deployment of meteorological buoys and geotechnical and geophysical surveys.

EPA
Section 328(a) of the Clean Air Act (CAA) (42 U.S.C. § 7401 *et seq.*) as amended by Public Law 101-549 enacted on November 15, 1990, required the EPA to establish air pollution control requirements for OCS sources subject to the OCSLA for all areas of the OCS, except those located in the Gulf of Mexico west of 87.5 degrees longitude (near the border of Florida and Alabama),[1] in order to attain and maintain Federal and State ambient air quality standards and comply with the provisions of part C of title I of the Act.[2] To comply with this statutory mandate, on September 4, 1992, EPA promulgated "Outer Continental Shelf Air Regulations" at 40 C.F.R. part 55. (57 Fed. Reg. 40,791). 40 C.F.R part 55 also established procedures for

[1] Public Law 112-74, enacted on December 23, 2011, amended § 328(a) to add an additional exception from EPA regulation for OCS sources "located offshore of the North Slope Borough of the State of Alaska."
[2] Part C of title I contains the Prevention of Significant Deterioration of Air Quality (PSD) requirements.

implementation and enforcement of air pollution control requirements for OCS sources. 40 C.F.R. § 55.2 states:

> OCS source means any equipment, activity, or facility, which:
> (1) Emits or has the potential to emit any air pollutant;
> (2) Is regulated or authorized under OCSLA (43 U.S.C. § 1331 *et seq.*); and,
> (3) Is located on the OCS or in or on waters above the OCS.
> This definition shall include vessels only when they are:
> (1) Permanently or temporarily attached to the seabed and erected thereon and used for the purpose of exploring, developing, or producing resources therefrom …; or
> (2) Physically attached to an OCS facility, in which case only the stationary sources aspects of the vessels will be regulated.

As described in the BA, where activities considered in this consultation emit or will have the potential to emit air pollutants and are located on the OCS or in or on waters above the OCS, the activities may be subject to the 40 C.F.R. part 55 requirements, including the 40 C.F.R. § 55.6 permitting requirements. Such activities are expected to be limited to vessel operations and some meteorological buoys.

USACE

Of the activities considered in this consultation, the deployment of meteorological buoys and carrying out geotechnical surveys may require authorization from the USACE. The USACE has regulatory responsibilities under Section 10 of the Rivers and Harbors Act of 1899 to approve/permit any structures or activities conducted below the mean high water line of navigable waters of the United States. The USACE also has responsibilities under Section 404 of the Clean Water Act (CWA) to prevent water pollution, obtain water discharge permits and water quality certifications, develop risk management plans, and maintain such records. A USACE Nationwide Permit (NWP) 5 or Regional General Permit (RGP) for Scientific Measurement Devices is required for devices and scientific equipment whose purpose is to record scientific data through such means as meteorological stations (which would include buoys); water recording and biological observation devices, water quality testing and improvement devices, and similar structures. In New England States, RGPs are required instead of the NWP. As stated in both types of permit, "*upon completion of the use of the device to measure and record scientific data, the measuring device and any other structures or fills associated with that device (e.g., foundations, anchors, buoys, lines, etc.) must be removed to the maximum extent practicable and the site restored to preconstruction elevations,*" as prescribed by Section 404 of the CWA (U. S. Army Corps of Engineers 2012).

Consideration of Potential Issuance of Incidental Harassment Authorizations for Survey Activities

The Marine Mammal Protection Act (MMPA), and its implementing regulations, allows, upon request, the incidental take of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographic region. Incidental take is an unintentional, but not unexpected, "take." Upon receipt and review of an adequate and complete application, NMFS OPR may authorize the incidental take of marine mammals incidental to the marine site characterization surveys pursuant to the MMPA, if the required findings are made. Proponents of some survey activities considered here may be required to obtain Incidental Take Authorizations (ITAs) under the MMPA. Therefore, the Federal actions considered in this consultation include the issuance of ITAs for survey activities described herein. Those ITAs may or may not provide MMPA take authorization for marine mammal species that are also listed under the ESA. As noted above, we have determined that all activities considered (inclusive of all PDC and BMPs) in this consultation will have no effect or are not likely to adversely affect any species listed under the ESA. By definition, that means that no take, as defined in the ESA, is anticipated. However, given the differences in the definitions of "harassment" under the MMPA and ESA, it is possible the site characterization surveys could result in harassment, as defined under the MMPA, but meet the ESA definition of "not likely to adversely affect." This consultation addresses such situations.

Under the MMPA (16 U.S.C. §1361 et seq.), take is defined as "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal" and further defined by regulation (50 C.F.R. §216.3). Harassment is defined under the MMPA as any act of pursuit, torment, or annoyance which: has the potential to injure a marine mammal or marine mammal stock in the wild (Level A Harassment); or has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B Harassment). As defined in the MMPA, Level B harassment does not include an act that has the potential to injure a marine mammal or marine mammal stock in the wild.

Under the ESA, take is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct." Harm is defined by regulation (50 C.F.R. §222.102) as "an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including, breeding, spawning, rearing, migrating, feeding, or sheltering." NMFS does not have a regulatory definition of "harass." However, on December 21, 2016, NMFS issued interim guidance[3] on the term "harass," under the ESA, defining it as to "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering." The NMFS interim ESA definition of "harass" is not equivalent to MMPA Level B harassment. Due to the differences in the definition of "harass" under the MMPA and ESA, there may be activities that result in effects to a marine mammal that would meet the threshold for harassment under both the MMPA and the ESA, while other activities may result in effects that would meet the threshold for harassment under the MMPA but not under the ESA. This issue is addressed further in the Marine Mammals section of this letter.

For this consultation, we considered NMFS' interim guidance on the term "harass" under the ESA when evaluating whether the proposed activities are likely to harass ESA-listed species, and we considered the available scientific evidence to determine the likely nature of the behavioral responses and their potential fitness consequences. As explained below, we determined that the effects to ESA-listed marine mammals resulting from the survey activities considered here would be insignificant and not result in harassment per NMFS' interim guidance on harassment under the ESA.

[3] NMFS Policy Directive 02-110-19; available at *https://media.fisheries.noaa.gov/dam-migration/02-110-19.pdf*; last accessed March 25, 2021.

Activities Considered in this Programmatic Consultation
The survey activities that are considered here consist of high resolution geophysical (HRG) and geotechnical surveys designed to characterize benthic and subsurface conditions and deployment, operation, and retrieval of environmental data collection buoys. A complete description of representative survey equipment to be used is included in Appendix A (Tables A.1 and A.2). Additionally, this consultation considers effects of deploying, operating, and retrieving buoys equipped with scientific instrumentation to collect oceanographic, meteorological, and biological data. All activities considered here will comply with a set of PDC (see Appendix B). We also consider the effects of vessel traffic associated with these activities. All vessels carrying out these activities, including during transits, will comply with measures outlined in Appendix B regardless of the equipment used or the sound levels/frequency at which equipment is operating. This consultation does not consider the effects of any survey activities that have the potential to result in directed or incidental capture or collection of any ESA-listed species (e.g., trawl surveys in areas where ESA-listed sea turtles occur).

This consultation does not evaluate the construction of any commercial electricity generating facilities or transmission cables with the potential to export electricity. Consistent with our understanding of the relevant regulations, BOEM has indicated that any such proposals for installation of electricity generating facilities (i.e., installation of wind turbines) or transmission cables would be a separate federal action (including authorization from BOEM) requiring a separate section 7 consultation. "Effects of the action are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action" (50 CFR §402.02; see also 50 CFR §402.17). The construction, operation, and/or decommissioning of any offshore wind facility or appurtenant facilities (e.g., cables, substations, etc.) are not consequences of the proposed survey activities considered here as they are not reasonably certain to occur. As such, this consultation does not consider these activities.

Action Area
The action area is defined by regulation as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR 402.02). The Action Area for this consultation includes the areas to be surveyed and where buoys will be deployed, areas where increased levels of noise will be experienced as well as the vessel transit routes between existing Atlantic coast ports and the survey area. This area encompasses all effects of the proposed action considered here.

Surveys considered in this programmatic consultation will take place at depths 100-meters (m) or less within the three Atlantic Renewable Energy Regions (North Atlantic Planning Area, Mid-Atlantic Planning Area, and South Atlantic Planning Area) located on the Atlantic Outer Continental Shelf (OCS) and may also occur along potential cable corridor routes in nearshore waters of Atlantic coast states. The three planning areas extend from the US/Canada border in the north to Palm Bay, Florida in the south. The North, Mid-Atlantic, and South Atlantic planning areas together extend seaward from the U.S./Canadian border in the North to Palm Bay, Florida in the South. For the purposes of this consultation, the action area includes the Atlantic Renewable Energy Regions in OCS waters out to the 100 m depth contour in the North Atlantic, extending from waters offshore Maine to New Jersey; Mid-Atlantic, extending from waters offshore Delaware to North Carolina; and the South Atlantic extending from waters offshore South Carolina to east-central Florida and the adjacent coastal waters to the Atlantic coast (see Figure 1 in Appendix A for map of the action area). The offshore extent of the action area is defined by the anticipated maximum water depth where potential offshore wind facilities could be constructed. The seaward limit for siting a wind energy facility on the OCS is approximately 25 nautical miles (nm) (46.3 kilometers [km]) from shore or 100 m (328 feet [ft.]) water depth due to economic viability limitations. The current fixed foundation technologies are limited to depths of about 60 m. Although the majority of site assessment and site characterization activities will occur in water <60 m to accommodate the depth limitations in support of fixed foundations for wind turbine generators, floating foundations may be used in water depths >60 m in the future.

IMPLEMENTATION, TRACKING, AND REPORTING FOR THIS PROGRAMMATIC CONSULTATION

As noted above, activities considered in this consultation may be authorized, funded, or carried out by one or more action agencies. When one of these action agencies identifies a proposed activity that they believe falls within the scope of this programmatic consultation, they will first identify a lead action agency for the review (we anticipate that in most cases this will be BOEM). They will then review the activity to confirm that it is consistent with the activities covered by this consultation, including a review to confirm that all relevant PDCs (as outlined in Appendix B) will be implemented. The lead action agency for the activity will send written correspondence to the NMFS Greater Atlantic Regional Fisheries Office (GARFO) (nmfs.gar.esa.section7@noaa.gov) providing a brief summary of the proposed activity, including location and duration, and the agency's determination that the proposed activity is consistent with the scope of activities considered in this consultation. The action agency will also confirm in writing that all relevant PDCs will be implemented. If NMFS GARFO has any questions about the activity or determines it is not within the scope of this consultation, a written reply will be provided to the action agency within 15 calendar days. Activities that are determined to not be within the scope of this consultation can be modified by the action agency to bring them within the scope of this consultation or the action agency can request a stand-alone ESA section 7 consultation outside of this programmatic consultation.

To provide flexibility while maintaining the intent of this programmatic consultation, if an action agency proposes use of an equipment type different than described in this consultation, but can demonstrate that the acoustic characteristics are similar to the representative equipment described in Table A.2 and that implementation of the PDCs will result in the same effects considered here, this can be described when the survey plan is transmitted to us. Similarly, it is possible to consider modifications to the PDCs for a particular survey plan when the lead action agency can demonstrate that the same conservation benefit or risk reduction can be achieved with an alternate proposal.

In order to track activities carried out under this programmatic consultation, by February 15 of each year, BOEM, as the lead agency for this programmatic consultation, will provide a written report to NMFS documenting the activities that occurred under the scope of this consultation in the previous year (e.g., the report for 2021 activities will be due by February 15, 2022). This annual report will also transmit any monitoring reports and any reports of instances where PDCs were not implemented (e.g., where human safety prevented implementation of an otherwise required speed reduction). Following the receipt of the annual report, a meeting will be held if necessary to review and update any PDCs and to update the list of representative equipment.

ESA-LISTED SPECIES AND CRITICAL HABITAT CONSIDERED IN THIS CONSULTATION

In their BA, BOEM described the ESA-listed species and critical habitats that occur along the U.S. Atlantic coast. Of the species listed in the BA, we have determined that oceanic whitetip shark (*Carcharhinus longimanus*), Nassau grouper (*Epinephelus striatus*)[4], staghorn coral (*Acropora cervicornis*), elkhorn coral (*Acropora palmata*), pillar coral (*Dendrogyra cylindrus*), rough cactus coral (*Mycetophyllia ferox*), lobed star coral (*Orbicella annularis*), mountainous star coral (*Orbicella faveolata*), and boulder star coral (*Orbicella franksi*) do not occur in the action area.

ESA-Listed Species in the Action Area

The following listed species occur in the action area and are considered in this consultation:

Table 1. ESA-listed species that may be affected by the proposed action.

Common Name	Scientific Name	ESA Status
Marine Mammals – Cetaceans		
North Atlantic right whale	*Eubalaena glacialis*	Endangered
Fin Whale	*Balaenoptera physalus*	Endangered
Sei Whale	*Balaenoptera borealis*	Endangered
Sperm Whale	*Physeter macrocephalus*	Endangered
Blue whale	*Balaenoptera musculus*	Endangered
Sea Turtles		
Loggerhead turtle - Northwest Atlantic DPS	*Caretta*	Threatened
Green turtle - North Atlantic DPS and South Atlantic DPS	*Chelonia mydas*	Threatened
Kemp's ridley turtle	*Lepidochelys kempii*	Endangered

[4] Nassau grouper may occur in nearshore and offshore waters in the Florida Straits Planning Area but are not known to occur in nearshore or offshore waters of the South Atlantic Planning Area (NMFS 2013)

Leatherback turtle	*Dermochelys coriacea*	Endangered
Hawksbill turtle	*Eretmochelys imbricata*	Endangered
Fishes		
Atlantic salmon	*Salmo salar*	Endangered
Atlantic sturgeon	*Acipenser oxyrinchus*	Endangered
New York Bight DPS		Endangered
Chesapeake Bay DPS		Endangered
Carolina DPS		Endangered
South Atlantic DPS		Endangered
Gulf of Maine DPS		Threatened
Giant Manta Ray	*Manta birostris*	Threatened
Shortnose sturgeon	*Acipenser brevirostrum*	Endangered
Smalltooth sawfish	*Pristis pectinate*	Endangered

BOEM has determined the proposed action is not likely to adversely affect any of these species. We concur with this determination based on the rationale presented below. More information on the status of the species and critical habitat considered in this consultation, as well as relevant listing documents, status reviews, and recovery plans, can be found within the BA and on NMFS webpages accessible at: *https://www.greateratlantic.fisheries.noaa.gov/protected/section7/listing/index.html*, *https://sero.nmfs.noaa.gov/protected_resources/section_7/threatened_endangered/index.html*, and *https://www.fisheries.noaa.gov/species-directory*.

Critical Habitat in the Action Area

The action area overlaps, at least in part, with critical habitat designated for all five DPSs of Atlantic sturgeon, North Atlantic right whales, and the Northwest Atlantic Ocean DPS of loggerhead sea turtles. While critical habitat is designated for some of the other species considered in this consultation, that critical habitat does not occur in the action area. Critical habitat for the Gulf of Maine DPS of Atlantic salmon is limited to certain mainstem rivers in the State of Maine. At this time, we do not know of any geotechnical or geophysical survey activities that are likely to occur in those waters. As such, the proposed action will not overlap with critical habitat designated for the Gulf of Maine DPS of Atlantic salmon. BOEM determined that the activities considered here may affect, but are not likely to adversely affect critical habitat designated for the five DPSs of Atlantic sturgeon or the Northwest Atlantic DPS of loggerhead sea turtles. We concur with these determinations based on the rationale presented in the Effects of the Action section below.

BOEM determined that the activities considered here would have no effect on critical habitat designated for North Atlantic right whales. We agree with this determination as described briefly below.

Critical Habitat designated for the North Atlantic Right Whale

On January 27, 2016, NMFS issued a final rule designating critical habitat for North Atlantic right whales (81 FR 4837). Critical habitat includes two areas (Units) located in the Gulf of Maine and Georges Bank Region (Unit 1) and off the coast of North Carolina, South Carolina, Georgia and Florida (Unit 2). Geophysical and geotechnical surveys and met buoy deployment may occur in Unit 1 and Unit 2. Note that there are seasonal restrictions on certain acoustic survey equipment in Unit 1 and Unit 2 (PDC 4); however, these seasonal restrictions are in place to further reduce the potential for effects to right whales in these areas and are not related to effects on the features of that critical habitat.

Consideration of Potential Effects to Unit 1

As identified in the final rule (81 FR 4837), the physical and biological features essential to the conservation of the North Atlantic right whale that provide foraging area functions in Unit 1 are: The physical oceanographic conditions and structures of the Gulf of Maine and Georges Bank region that combine to distribute and aggregate *C. finmarchicus* for right whale foraging, namely prevailing currents and circulation patterns, bathymetric features (basins, banks, and channels), oceanic fronts, density gradients, and temperature regimes; low flow velocities in Jordan, Wilkinson, and Georges Basins that allow diapausing *C. finmarchicus* to aggregate passively below the convective layer so that the copepods are retained in the basins; late stage *C. finmarchicus* in dense aggregations in the Gulf of Maine and Georges Bank region; and diapausing *C. finmarchicus* in aggregations in the Gulf of Maine and Georges Bank region.

The activities considered here will not affect the physical oceanographic conditions and structures of the region that distribute and aggregate *C. finmarchicus* for foraging. This is because the activities considered here have no potential to affect currents and circulation patterns, flow velocities, bathymetric features (basins, banks, and channels), oceanic fronts, density gradients, or temperature regimes. Therefore, we have determined that the activities considered in this programmatic consultation will have no effect on Unit 1 of right whale critical habitat.

Consideration of Potential Effects to Unit 2

As identified in the final rule (81 FR 4837), the physical and biological features essential to the conservation of the North Atlantic right whale, which provide calving area functions in Unit 2, are: (i) Sea surface conditions associated with Force 4 or less on the Beaufort Scale; (ii) Sea surface temperatures of 7 °C to 17 °C; and, (iii) Water depths of 6 to 28 meters, where these features simultaneously co-occur over contiguous areas of at least 231 nmi^2 of ocean waters during the months of November through April. When these features are available, they are selected by right whale cows and calves in dynamic combinations that are suitable for calving, nursing, and rearing, and which vary, within the ranges specified, depending on factors such as weather and age of the calves.

The activities considered here will have no effect on the features of Unit 2; this is because geophysical and geotechnical surveys, met buoys, and vessel operations do not affect sea surface state, water temperature, or water depth. Therefore, we have determined that the activities considered in this programmatic consultation will have no effect on Unit 2 of right whale critical habitat

EFFECTS OF THE ACTION ON NMFS LISTED SPECIES AND CRITICAL HABITAT

Potential effects of the proposed action on listed species can be broadly categorized into the following categories: (1) effects to individual animals of exposure to noise associated with the survey activities (HRG, geotechnical), (2) effects of buoy deployment, operation, and retrieval; (3) effects to habitat from survey activities (including consideration of effects to Atlantic sturgeon and loggerhead critical habitat), and (4) effects of vessel use.

Effects of Exposure to Noise Associated With Survey Activities

Here we consider effects of noise associated with HRG and geotechnical surveys on ESA-listed species. Noise associated with meteorological buoys and vessel operations is discussed in those sections of this consultation.

Acoustic Thresholds

Due to the different hearing sensitivities of different species groups, NMFS uses different sets of acoustic thresholds to consider effects of noise on ESA-listed species. Below, we present information on thresholds considered for ESA-listed whales, sea turtles, and fish considered in this consultation.

ESA-listed Whales

NMFS *Technical Guidance for Assessing the Effects of Anthropogenic Noise on Marine Mammal Hearing* compiles, interprets, and synthesizes scientific literature to produce updated acoustic thresholds to assess how anthropogenic, or human-caused, sound affects the hearing of all marine mammals under NMFS jurisdiction (NMFS 2018[5]). Specifically, it identifies the received levels, or thresholds, at which individual marine mammals are predicted to experience temporary or permanent changes in their hearing sensitivity for acute, incidental exposure to underwater anthropogenic sound sources. As explained in the document, these thresholds represent the best available scientific information. These acoustic thresholds cover the onset of both temporary (TTS) and permanent hearing threshold shifts (PTS).

[5] See *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance* for more information.

Table 2. Impulsive acoustic thresholds identifying the onset of permanent threshold shift and temporary threshold shift for ESA-listed whales (NMFS 2018).

Hearing Group	Generalized Hearing Range[6]	Permanent Threshold Shift Onset[7]	Temporary Threshold Shift Onset
Low-Frequency Cetaceans (LF: baleen whales)	7 Hz to 35 kHz	Lpk,flat: 219 dB LE,LF,24h: 183 dB	Lpk,flat: 213 dB LE,LF,24h: 168 dB
Mid-Frequency Cetaceans (MF: sperm whales)	150 Hz to 160 kHz	Lpk,flat: 230 dB LE,MF,24h: 185 dB	Lpk,flat: 224 dB LE,MF,24h: 170 dB

These thresholds are a dual metric for impulsive sounds, with one threshold based on peak sound pressure level (0-pk SPL) that does not incorporate the duration of exposure, and another based on cumulative sound exposure level (SEL_{cum}) that does incorporate exposure duration. The two metrics also differ in regard to considering information on species hearing. The cumulative sound exposure criteria incorporate auditory weighting functions, which estimate a species group's hearing sensitivity, and thus susceptibility to TTS and PTS, over the exposed frequency range, whereas peak sound exposure level criteria do not incorporate any frequency dependent auditory weighting functions.

Additionally, NMFS considers exposure to impulsive/intermittent noise greater than 160 dB re 1uPa rms to have the potential to result in Level B harassment, as defined under the MMPA (which does not necessarily equate to ESA harassment). This value is based on observations of behavioral responses of baleen whales (Malme et al. 1983; Malme et al. 1984; Richardson et al. 1986; Richardson et al. 1990), but is used for all marine mammal species.

Sea Turtles

In order to evaluate the effects of exposure to the survey noise by sea turtles, we rely on the available scientific literature. Sea turtles are low frequency hearing specialists, typically hearing frequencies from 30 Hz to 2 kHz, with a range of maximum sensitivity between 100 to 800 Hz (Ridgway et al. 1969, Lenhardt 1994, Bartol et al. 1999, Lenhardt 2002, Bartol and Ketten 2006). Currently, the best available data regarding the potential for noise to cause behavioral disturbance come from studies by O'Hara and Wilcox (1990) and McCauley et al. (2000), who experimentally examined behavioral responses of sea turtles in response to seismic airguns. O'Hara and Wilcox

[6] Represents the generalized hearing range for the entire group as a composite (i.e., all species within the group), where individual species' hearing ranges are typically not as broad. Generalized hearing range chosen based on approximately 65 dB threshold from normalized composite audiogram, with the exception for lower limits for LF cetaceans (Southall et al. 2007).

[7] $L_{pk,flat}$: unweighted ($_{flat}$) peak sound pressure level (L_{pk}) with a reference value of 1 µPa; $L_{E,XF,24h}$: weighted (by species group; $_{LF}$: Low Frequency, or $_{MF}$: Mid-Frequency) cumulative sound exposure level (L_E) with a reference value of 1 $µPa^2$-s and a recommended accumulation period of 24 hours ($_{24h}$)

(1990) found that loggerhead turtles exhibited avoidance behavior at estimated sound levels of 175 to 176 dB re: 1 µPa (rms) (or slightly less) in a shallow canal. McCauley et al. (2000) reported a noticeable increase in swimming behavior for both green and loggerhead turtles at received levels of 166 dB re: 1 µPa (rms). At 175 dB re: 1 µPa (rms), both green and loggerhead turtles displayed increased swimming speed and increasingly erratic behavior (McCauley et al. 2000). Based on these data, we assume that sea turtles would exhibit a behavioral response when exposed to received levels of 175 dB re: 1 µPa (rms) and higher.

In order to evaluate the effects of exposure to the survey noise by sea turtles that could result in physical effects, we relied on the available literature related to the noise levels that would be expected to result in sound-induced hearing loss (i.e., temporary threshold shift (TTS) or permanent threshold shift (PTS)); we relied on acoustic thresholds for PTS and TTS for impulsive sounds developed by the U.S. Navy for Phase III of their programmatic approach to evaluating the environmental effects of their military readiness activities (U.S. Navy 2017). At the time of this consultation, we consider these the best available data since they rely on all available information on sea turtle hearing and employ the same statistical methodology to derive thresholds as in NMFS recently issued technical guidance for auditory injury of marine mammals (NMFS 2018). Below we briefly detail these thresholds and their derivation. More information can be found in the U.S. Navy's Technical report on the subject (U.S. Navy 2017).

To estimate received levels from airguns and other impulsive sources expected to produce TTS in sea turtles, the U.S. Navy compiled all sea turtle audiograms available in the literature in an effort to create a composite audiogram for sea turtles as a hearing group. Since these data were insufficient to successfully model a composite audiogram via a fitted curve as was done for marine mammals, median audiogram values were used in forming the hearing group's composite audiogram. Based on this composite audiogram and data on the onset of TTS in fishes, an auditory weighting function was created to estimate the susceptibility of sea turtles to TTS. Data from fishes were used since there are currently no data on TTS for sea turtles and fishes are considered to have hearing more similar to sea turtles than do marine mammals (Popper et al. 2014). Assuming a similar relationship between TTS onset and PTS onset as has been described for humans and the available data on marine mammals, an extrapolation to PTS susceptibility of sea turtles was made based on the methods proposed by (Southall et al. 2007). From these data and analyses, dual metric thresholds were established similar to those for marine mammals: one threshold based on peak sound pressure level (0-pk SPL) that does not incorporate the auditory weighting function nor the duration of exposure, and another based on cumulative sound exposure level (SEL_{cum}) that incorporates both the auditory weighting function and the exposure duration (Table 3).

Table 3. Acoustic thresholds identifying the onset of permanent threshold shift and temporary threshold shift for sea turtles exposed to impulsive sounds (U.S. Navy 2017, McCauley et al. 2000).

Hearing Group	Generalized Hearing Range	Permanent Threshold Shift Onset	Temporary Threshold Shift Onset	Behavioral Response
Sea Turtles	30 Hz to 2 kHz	204 dB re: 1 μPa^2·s SEL$_{cum}$	189 dB re: 1 μPa^2·s SEL$_{cum}$	175 dB re: 1 μPa (rms)
		232 dB re: 1 μPa SPL (0-pk)	226 dB re: 1 μPa SPL (0-pk)	

Marine Fish

There are no criteria developed for considering effects to ESA-listed fish specific to HRG equipment. However, all of the equipment that operates within a frequency that these fish species are expected to respond to, produces intermittent or impulsive sounds; therefore, it is reasonable to use the criteria developed for impact pile driving, seismic, and explosives when considering effects of exposure to this equipment (FHWG 2008). However, unlike impact pile driving, which produces repetitive impulsive noise in a single location, the geophysical survey sound sources are moving; therefore, the potential for repeated exposure to multiple pulses is much lower when compared to pile driving. We expect fish to react to noise that is disturbing by moving away from the sound source and avoiding further exposure. Injury and mortality is only known to occur when fish are very close to the noise source and the noise is very loud and typically associated with pressure changes (i.e., impact pile driving or blasting).

The Fisheries Hydroacoustic Working Group (FHWG) was formed in 2004 and consists of biologists from NMFS, United States Fish and Wildlife Service, Federal Highway Administration, USACE, and the California, Washington, and Oregon Department of Transportations, supported by national experts on underwater sound producing activities that affect fish and wildlife species of concern. In June 2008, the agencies signed an MOA documenting criteria for assessing physiological effects of impact pile driving on fish. The criteria were developed for the acoustic levels at which physiological effects to fish could be expected. It should be noted, that these are onset of physiological effects (Stadler and Woodbury, 2009), and not levels at which fish are necessarily mortally damaged. These criteria were developed to apply to all fish species. The interim criteria are:

- Peak SPL: 206 dB re 1 μPa
- SELcum: 187 B re 1μPa^2-s for fishes 2 grams or larger (0.07 ounces).
- SELcum: 183 dB re 1μPa^2-s for fishes less than 2 grams (0.07 ounces).

At this time, these criteria represent the best available information on the thresholds at which physiological effects to ESA-listed marine fish are likely to occur. It is important to note that physiological effects may range from minor injuries from which individuals are anticipated to completely recover with no impact to fitness to significant injuries that will lead to death. The severity of injury is related to the distance from the noise source and the duration of exposure. The closer to the source and the greater the duration of the exposure, the higher likelihood of significant injury. Use of the 183 dB re 1 μPa^2-s cSEL threshold, is not appropriate for this consultation because all sturgeon in the action area will be larger than 2 grams. Physiological effects could range from minor injuries that a fish is expected to completely recover from with no impairment to survival to major injuries that increase the potential for mortality, or result in death.

We use 150 dB re: 1 μPa RMS as a threshold for examining the potential for behavioral responses by individual listed fish to noise with frequency less than 1 kHz. This is supported by information provided in a number of studies (Andersson et al. 2007, Purser and Radford 2011, Wysocki et al. 2007). Responses to temporary exposure of noise of this level is expected to be a range of responses indicating that a fish detects the sound, these can be brief startle responses or in the worst case, we expect that listed fish would completely avoid the area ensonified above 150 dB re: 1 uPa rms. Popper et al. (2014) does not identify a behavioral threshold but notes that the potential for behavioral disturbance decreases with the distance from the source.

HRG Acoustic Sources

HRG surveys are used for a number of site characterization purposes: locating shallow hazards, cultural resources, and hard-bottom areas; evaluating installation feasibility; assisting in the selection of appropriate foundation system designs; and determining the variability of subsurface sediments. The equipment typically used for these surveys includes: Bathymetry/Depth Sounder; Magnetometer; Seafloor Imagery/Side-Scan Sonar; Shallow and Medium (Seismic) Penetration Sub-bottom Profilers (e.g., CHIRPs, boomers, bubble guns). This consultation does not consider the use of seismic airguns because this equipment is not required for site characterization activities to support offshore wind development (due to the shallow sediment depths that need to be examined, compared to the miles into the seabed that are examined for oil and gas exploration where airguns are used).

As described in the BA, BOEM completed a desktop analysis of nineteen HRG sources in Crocker and Fratantonio (2016) to evaluate the distance to thresholds of concern for listed species (see tables in Appendix A). Equipment types or frequency settings that would not be used for the survey purposes by the offshore wind industry were not included in this analysis. To provide the maximum impact scenario for these calculations, the highest power levels and most sensitive frequency setting for each hearing group were used when the equipment had the option for multiple user settings. All sources were analyzed at a tow speed of 2.315 m/s (4.5 knots), which is the expected speed vessels will travel while towing equipment. PTS cumulative exposure distances were calculated for the low-frequency hearing group (sei, fin, and North Atlantic right whales), the mid-frequency group (sperm whales), and for a worst-case exposure scenario of 60 continuous minutes for sea turtles and fish.

Tables 4 and 5 describe the greatest distances to thresholds of concern for the various equipment types analyzed by BOEM. It is important to note that as different species groups have different hearing sensitivities, not all equipment operates within the hearing threshold of all species considered here. Complete tables are included in Appendix B of BOEM's BA.

Table 1. Summary of greatest PTS Exposure Distances from mobile HRG Sources at Speeds of 4.5 knots.

HRG SOURCE	PTS DISTANCE (m)								
	Highest Source Level (dB re 1 μPa)	Sea Turtles		Fish[b]		Baleen Whales		Sperm Whales[c]	
Mobile, Impulsive, Intermittent Sources									
		Peak	*SEL*	*Peak*	*SEL*	*Peak*	*SEL*	*Peak*	*SEL*
Boomers, Bubble Guns	176 dB SEL 207 dB RMS 216 PEAK	0	0	3.2	0	0	0.3	0	0
Sparkers	188 dB SEL 214 dB RMS 225 PEAK	0	0	9	0	2	12.7	0	0.2
Chirp Sub-Bottom Profilers	193 dB SEL 209 dB RMS 214 PEAK	NA	NA	NA	NA	0	1.2	0	0.3
Mobile, Non-impulsive, Intermittent Sources									
Multi-beam echosounder (100 kHz)	185 dB SEL 224 dB RMS 228 PEAK	NA	NA	NA	NA	NA	NA	0	0.5
Multi-beam echosounder (>200 kHz) (mobile, non-impulsive, intermittent)	182 dB SEL 218 dB RMS 223 PEAK	NA	NA	NA	NA	NA	NA	NA	NA
Side-scan sonar (>200 kHz) (mobile, non-impulsive, intermittent)	184 dB SEL 220 dB RMS 226 PEAK	NA	NA	NA	NA	NA	NA	NA	NA

[a] Sea turtle PTS distances were calculated for 203 cSEL and 230 dB peak criteria from Navy (2017).
[b] Fisheries Hydroacoustic Working Group (2008).
[c] PTS injury distances for listed marine mammals were calculated with NOAA's sound exposure spreadsheet tool using sound source characteristics for HRG sources in Crocker and Fratantonio (2016)
NA = not applicable due to the sound source being out of the hearing range for the group.

Using the same sound sources for the PTS analysis, BOEM calculated the distances to 175 dB re 1 μPa rms for sea turtles, 160 dB re 1 μPa rms for marine mammals, and 150 dB re 1 μPa rms for fish were calculated using a spherical spreading model (20 LogR) (Table 5). BOEM has conservatively used the highest power levels for each sound source reported in Crocker and Fratantonio (2016). Additionally, the spreadsheet and geometric spreading models do not consider the tow depth and directionality of the sources; therefore, these are likely overestimates of actual disturbance distances.

Table 5. Summary of greatest disturbance distances by equipment type.

HRG SOURCE	DISTURBANCE DISTANCE (m)			
	Sea Turtles (175 dB re 1uPa rms)	Fish (150 dB re 1uPa rms)	Baleen Whales (160 dB re 1uPa rms)	Sperm Whales (160 dB re 1uPa rms)
Boomers, Bubble Guns	40	708	224	224
Sparkers	90	1,996[a]	502	502
Chirp Sub-Bottom Profilers	2	32	10	10
Multi-beam Echosounder (100 kHz)	NA	NA	NA	<369[b]
Multi-beam Echosounder (>200 kHz)	NA	NA	NA	NA
Side-scan Sonar (>200 kHz)	NA	NA	NA	NA

a – the calculated distance to the 150 dB rms threshold for the Applied Acoustics Dura-Spark is 1,996m; however, the distances for other equipment in this category is significantly smaller
b – this distance was recalculated using the NMFS spreadsheet following receipt of the BA.
NA = not applicable due to the sound source being out of the hearing range for the group.

Marine Mammals
Considering peak noise levels, the equipment resulting in the greatest isopleth to the marine mammal PTS threshold is the sparker (2.0 m for baleen whales, 0 m for sperm whales; Table A.3). Considering the cumulative threshold (24 hour exposure), the greatest distance to the PTS threshold is 12.7 m for baleen whales and 0.5 m for sperm whales. Animals in the survey area during the HRG survey are unlikely to incur any hearing impairment due to the characteristics of the sound sources, considering the source levels (176 to 205 dB re 1 µPa-m) and generally very short pulses and duration of the sound. Individuals would have to make a very close approach and

also remain very close to vessels operating these sources (<13 m) in order to receive multiple exposures at relatively high levels, as would be necessary to have the potential to result in any hearing impairment. Kremser et al. (2005) noted that the probability of a whale swimming through the area of exposure when a sub-bottom profiler emits a pulse is small—because if the animal was in the area, it would have to pass the transducer at close range in order to be subjected to sound levels that could cause PTS and would likely exhibit avoidance behavior to the area near the transducer rather than swim through at such a close range. Further, the restricted beam shape of many of HRG survey devices planned for use makes it unlikely that an animal would be exposed more than briefly during the passage of the vessel. The potential for exposure to noise that could result in PTS is even further reduced by the clearance zone and the use of PSOs to all for a shutdown of equipment operating within the hearing range of ESA-listed whales should a right whale or unidentified large whale be detected within 500 m or 100 m for an identified sei, fin, or sperm whale, see PDC 4. Based on these considerations, it is extremely unlikely that any ESA-listed whale will be exposed to noise that could result in PTS.

Masking is the obscuring of sounds of interest to an animal by other sounds, typically at similar frequencies. Marine mammals are highly dependent on sound, and their ability to recognize sound signals amid other sounds is important in communication and detection of both predators and prey (Tyack 2000). Although masking is a phenomenon which may occur naturally, the introduction of loud anthropogenic sounds into the marine environment at frequencies important to marine mammals increases the severity and frequency of occurrence of masking. The components of background noise that are similar in frequency to the signal in question primarily determine the degree of masking of that signal. In general, little is known about the degree to which marine mammals rely upon detection of sounds from conspecifics, predators, prey, or other natural sources. In the absence of specific information about the importance of detecting these natural sounds, it is not possible to predict the impact of masking on marine mammals (Richardson et al., 1995). In general, masking effects are expected to be less severe when sounds are transient than when they are continuous. Masking is typically of greater concern for those marine mammals that utilize low-frequency communications, such as baleen whales, because of how far low-frequency sounds propagate. NMFS has previously concluded that marine mammal communications would not likely be masked appreciably by the sub-bottom profiler signals given the directionality of the signals for most HRG survey equipment types planned for use for the types of surveys considered here and the brief period when an individual mammal is likely to be within its beam (see for example, 86 FR 22160). Based on this, any effects of masking on ESA-listed whales will be insignificant.

For equipment that operates within the functional hearing range (7 Hz to 35 kHz) of baleen whales, the area ensonified by noise greater than 160 dB re: 1uPa rms will extend no further than 502 m from the source (sparkers; the distance for chirp (10 m) and boomers and bubble guns (224 m) is smaller (Table A.5)). For equipment that operates within the functional hearing range of sperm whales (150 Hz to 160 kHz), the area ensonified by noise greater than 160 dB re: 1uPa rms will extend no further than 369 m from the source (100 kHz Multi-beam echosounder; the distance for sparkers (502 m), boomers and bubble guns (224 m), and chirp (10 m) is smaller; Table A.5).

Given that the distance to the 160 dB re: 1 uPa rms threshold extends beyond the required Shutdown Zone, it is possible that ESA-listed whales will be exposed to potentially disturbing levels of noise during the surveys considered here. We have determined that, in this case, the exposure to noise above the MMPA Level B harassment threshold (160 dB re: 1uPa rms) will result in effects that are insignificant. We expect that the result of this exposure would be, at worst, temporary avoidance of the area with underwater noise louder than this threshold, which is a reaction that is considered to be of low severity and with no lasting biological consequences (e.g., Ellison et al. 2007). The noise source itself will be moving. This means that any co-occurrence between a whale, even if stationary, will be brief and temporary. Given that exposure will be short (no more than a few seconds, given that the noise signals themselves are short and intermittent and because the vessel towing the noise source is moving) and that the reaction to exposure is expected to be limited to changing course and swimming away from the noise source only far/long enough to get out of the ensonified area (502 m or less, depending on the noise source), the effect of this exposure and resulting response will be so small that it will not be able to be meaningfully detected, measured or evaluated and, therefore, is insignificant. Further, the potential for disruption to activities such as breeding, feeding (including nursing), resting, and migrating is extremely unlikely given the very brief exposure to any noise (given that the source is traveling and the area ensonified at any given moment is so small). Any brief interruptions of these behaviors are not anticipated to have any lasting effects. Because the effects of these temporary behavioral changes are so minor, it is not reasonable to expect that, under the NMFS' interim ESA definition of harassment, they are equivalent to an act that would "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering."

Sea Turtles

None of the equipment being operated for these surveys that overlaps with the hearing range (30 Hz to 2 kHz) for sea turtles has source levels loud enough to result in PTS or TTS based on the peak or cumulative exposure criteria (Table A.4). Therefore, physical effects are extremely unlikely to occur.

As explained above, we assume that sea turtles would exhibit a behavioral response when exposed to received levels of 175 dB re: 1 µPa (rms) and are within their hearing range (below 2 kHz). For boomers and bubble guns the distance to this threshold is 40 m, and is 90 m for sparkers and 2 m for chirps (Table A.5). Thus, a sea turtle would need to be within 90 m of the source to be exposed to potentially disturbing levels of noise. We expect that sea turtles would react to this exposure by swimming away from the sound source; this would limit exposure to a short time period, just the few seconds it would take an individual to swim away to avoid the noise.

The risk of exposure to potentially disturbing levels of noise is reduced by the use of PSOs to monitor for sea turtles. As required by the PDC 4, a Clearance Zone (500 m in all directions) for ESA-listed species must be monitored around all vessels operating equipment at a frequency of less than 180 kHz. At the start of a survey, equipment cannot be turned on until the Clearance Zone is clear for at least 30 minutes. This condition is expected to reduce the potential for sea turtles to be exposed to noise that may be disturbing. However, even in the event that a sea turtle is submerged and not seen by the PSO, in the worst case, we expect that sea turtles would avoid the area ensonified by the survey equipment that they can perceive. Because the area where increased underwater noise will be experienced is transient and increased underwater noise will only be experienced in a particular area for only seconds, we expect any effects to behavior to be minor and limited to a temporary disruption of normal behaviors, temporary avoidance of the ensonified area and minor additional energy expenditure spent while swimming away from the noisy area. If foraging or migrations are disrupted, we expect that they will quickly resume once the survey vessel has left the area. No sea turtles will be displaced from a particular area for more than a few minutes. While the movements of individual sea turtles will be affected by the sound associated with the survey, these effects will be temporary (seconds to minutes) and localized (avoiding an area no larger than 90 m) and there will be only a minor and temporary impact on foraging, migrating or resting sea turtles. For example, BOEM calculated that for a survey with equipment being towed at 3 knots, exposure of a turtle that was within 90 m of the source would last for less than two minutes. We also note that, to minimize disturbance to the Northwest Atlantic Ocean DPS of loggerhead sea turtles, a voluntary pause in sparker operation will be implemented for all vessels operating in nearshore critical habitat for loggerhead sea turtles if any loggerhead or other sea turtle is observed within a 100 m Clearance Zone during a survey. This will further reduce the potential for behavioral disturbance.

Given the intermittent and short duration of exposure to any potentially disturbing noise from HGR equipment, major shifts in habitat use or distribution or foraging success are not expected. Effects to individual sea turtles from brief exposure to potentially disturbing levels of noise are expected to be minor and limited to a brief startle, short increase in swimming speed and/or short displacement, and will be so small that they cannot be meaningfully measured, detected, or evaluated; therefore, effects are insignificant.

Marine Fish

Of the equipment that may be used for geophysical surveys, only equipment that operates at a frequency within the estimated hearing range of the ESA-listed fish that may occur in the action area (i.e., frequency less than 1 kHz; Lovell et al. 2005; Meyer et al. 2010) may affect these species. Generally, this includes sparkers, boomers, and bubble guns (see Table A.2). All other survey equipment operates at a frequency higher than the ESA-listed fish considered here are expected to hear; therefore, we do not expect any effects to ESA-listed fish exposed to increased underwater noise from the other higher frequency survey equipment. Due to their typically submerged nature, monitoring clearance or shutdown zones for marine fish is not expected to be effective. As required by PDC 4, the surveys will use a ramp up procedure; that is, noise producing equipment will not be used at full energy right away. This gives any fish in the immediate area a “warning” and an opportunity to leave the area before the full energy of the survey equipment is used.

As explained above, the available information suggests that for noise exposure to result in physiological impacts to the fish species considered here, received levels need to be at least 206 dB re: 1uPa peak sound pressure level (SPLpeak) or at least 187 dB re: u1Pa cumulative. The peak thresholds are exceeded only very close to the noise source (<3.2 m for the boomers/bubble guns and <9 m for the sparkers (see Table A.4); the cumulative threshold is not exceeded at any distance. As such, in order to be exposed to peak sound pressure levels of 206 dB re: 1uPa from any of these sources, an individual fish would need to be within 9 m of the source (Table A.4). This is extremely unlikely to occur given the dispersed nature of the distribution of ESA-listed fish in the action area, the use of a ramp up procedure, the moving and intermittent/pulsed characteristic of the noise source, and the expectation that ESA-listed fish will swim away, rather than towards the noise source. Based on this, no physical effects to any ESA-listed fish, including injury or mortality, are expected to result from exposure to noise from the geophysical surveys.

We use 150 dB re: 1 µPa root mean square (RMS) sound pressure level (SPL) as a threshold for examining the potential for behavioral responses to underwater noise by ESA-listed fish. This is supported by information provided in a number of studies (Andersson et al. 2007, Purser and Radford 2011, Wysocki et al. 2007). In the worst case, we expect that ESA-listed fish would completely avoid an area ensonified above 150 dB re: 1uPa rms for the period of time that noise in that area was elevated. The calculated distances to the 150 dB re: 1 uPa rms threshold for the boomers/bubble guns, sparkers, and sub-bottom profilers is 708 m, 1,996 m, and 32 m, respectively (Table A.5). It is important to note that BOEM has conservatively used the highest power levels for each sound source reported in Crocker and Fratantonio (2016) to calculate these distances; thus, they likely overestimate actual sound fields.

Because the area where increased underwater noise will be experienced is transient (because the survey vessel towing the equipment is moving), increased underwater noise will only be experienced in a particular area for a short period of time. Given the transient and temporary nature of the increased noise, we expect any effects to behavior to be minor and limited to a temporary disruption of normal behaviors, potential temporary avoidance of the ensonified area and minor additional energy expenditure spent while swimming away from the noisy area. If foraging, resting, or migrations are disrupted, we expect that these behaviors will quickly resume once the survey vessel has left the area (i.e., in seconds to minutes, given its traveling speed of 3 – 4.5 knots). Therefore, no fish will be displaced from a particular area for more than a few minutes. While the movements of individual fish will be affected by the sound associated with the survey, these effects will be temporary and localized and these fish are not expected to be excluded from any particular area and there will be only a minimal impact on foraging, migrating, or resting behaviors. Sustained shifts in habitat use or distribution or foraging success are not expected. Effects to individual fish from brief exposure to potentially disturbing levels of noise are expected to be limited to a brief startle or short displacement and will be so small that they cannot be meaningfully measured, detected, or evaluated; therefore, effects of exposure to survey noise are insignificant.

Acoustic Effects - Geotechnical Surveys

Geotechnical surveys generally do not use active acoustic sources, but may have some low-level ancillary sounds associated with them. As described in the BA, the loudest noises are from drilling associated with obtaining bore samples. Small-scale drilling noise associated with bore samples taken in shallow water has been measured to produce broadband sounds centered at 10 Hz with source levels at 71-89 dB re 1 µPa rms and 75-97 dB re 1 µPa peak depending on the water depth of the work site (Willis et al. 2010). Another study reported measured drilling noise from a small jack-up rig at 147 – 151 db re 1 µPa rms in the 1 Hz to 22 kHz range at 10 m from source (Erbe and McPherson 2017).

Noise associated with geotechnical surveys is below the level that we expect may result in physiological or behavioral responses by any ESA-listed species considered here. As such, effects to listed whales, sea turtles, or fish from exposure to this noise source are extremely unlikely to occur.

Meteorological Buoys

A meteorological buoy (met buoy) is designed to collect meteorological data for a period of four-five years. During this time, data will be collected and transmitted to onshore facilities. The operation of the meteorological data collection instrumentation (i.e., light detection and ranging remote sensing technology (LIDAR) and Acoustic Doppler Current Profilers (ADCP)) will have no effect on any listed species as it does not operate in any way that could result in effects to listed species. Bathymetric LIDAR uses water-penetrating green light to also measure seafloor and riverbed elevations. ADCP uses extremely high frequency sound (well above the hearing frequency of any species considered in this consultation) to measure water currents. No other acoustic effects from the deployment of the met buoys are anticipated.

Buoys will be deployed and retrieved by vessels; maintenance will also be carried out from vessels. Potential effects of vessel traffic for all activities considered in this consultation is addressed below. PDCs for siting the buoy will result in avoidance of anchoring buoys on any sensitive habitats (i.e., placement will occur on unconsolidated and uncolonized areas only, avoiding eelgrass, corals, etc.) (see PDC 1). Buoys will be anchored to a clump weight anchor and attached to the anchor with heavy chain. We have considered the potential for any listed species, including whales and/or sea turtles, to interact with the buoy and to become entangled in the buoy or mooring system and have determined that this is extremely unlikely to occur for the reasons outlined below.

In order for an entanglement to occur, an animal must first encounter the gear, which has an extremely low likelihood based on the number of buoys and total area where buoys may be deployed (Atlantic OCS). BOEM predicts that up to two met buoys could be deployed in any potential lease area, for a maximum of 60 buoys deployed in the entirety of the Atlantic OCS. Given the small number of buoys and their dispersed locations on the OCS, the potential for encounter between an individual whale or sea turtle and a buoy is extremely low. However even if there is co-occurrence between an individual animal and one or more buoys, entanglement is extremely unlikely to occur. This is because the buoy will be attached to the anchor with heavy gauge chain, which reduces the risk of entanglement due to the tension that the buoy will be under and the gauge of the chain, which prevents any slack in the chain that could result in an entanglement (see PDC 6). There have been no documented incidences of any listed species, including whales or sea turtles, entangled in United States Coast Guard navigational buoys, which have a similar mooring configuration to these met buoys, but also far outnumber the potential number of deployed met buoys (there are 1000s of navigational buoys within the range of ESA-listed whales and sea turtles and no recorded entanglements). Based on the analysis herein, it is extremely unlikely that any ESA-listed species will interact with the buoy and anchor system such that it becomes entangled. As such, effects are extremely unlikely to occur.

Effects to Habitat

Vibracores and grab samples may be used to document habitat types during geophysical and geotechnical survey activities. Both of these survey methods will result in temporary disturbance of the benthos and a potential temporary loss of benthic resources. Additionally, bottom disturbance will occur in the area where a met buoy is anchored.

The vibracores and grab samples will affect an extremely small area (approximately 0.1 to 2.7 ft^2) at each sampling location, with sampling locations several hundred meters apart. While the vibracore and grab sampler will take a portion of the benthos that will be brought onto the ship, because of the small size of the sample and the nature of the removal, there is little to no sediment plume associated with the sampling. While there may be some loss of benthic species at the sample sites, including potential forage items for listed species that feed on benthic resources, the amount of benthic resources potentially lost will be extremely small and limited to immobile individuals that cannot escape capture during sampling. As such a small area will be disturbed and there will be a large distance between disturbed areas, recolonization is expected to be rapid. The amount of potential forage lost for any benthic feeding species is extremely small, localized, and temporary. While the area of the bottom impacted by the anchoring of the met buoy is larger (i.e., several meters in diameter), as stated above, there will be a small number of buoys deployed along the entire Atlantic OCS. Any loss of benthic resources will be small, temporary, and localized.

These temporary, isolated reductions in the amount of benthic resources are not likely to have a measurable effect on any foraging activity or any other behavior of listed species; this is due to the small size of the affected areas in relation to remaining available habitat in the OCS and the temporary nature of any disturbance. As effects to listed species will be so small that they cannot be meaningfully measured, detected, or evaluated, effects are insignificant.

Other Considerations – Geotechnical Surveys
The PDCs include a seasonal prohibition on any activities involving disturbance of the bottom in areas where early life stages of Atlantic or shortnose sturgeon may occur (see PDC 2). The seasonal prohibition is designed to avoid any activity that could disturb potential spawning or rearing substrate during the time of year that spawning or rearing may occur in that river. This PDC will also ensure that no bottom disturbing survey activities will occur at a time that eggs or other immobile or minimally mobile early life stages of sturgeon are present. This will ensure that sampling activities will not result in the disturbance, injury, or mortality of any sturgeon. Based on this, any effects to sturgeon spawning habitat or early life stages are extremely unlikely to occur.

Atlantic Sturgeon Critical Habitat
Critical habitat has been designated for all five DPSs of Atlantic sturgeon (82 FR 39160; effective date September 18, 2017). While there is no Atlantic sturgeon critical habitat in the three Atlantic Renewable Energy Regions located on the Atlantic OCS, survey activities along potential cable routes, including vessel transits, may occur within Atlantic sturgeon critical habitat. While BOEM anticipates that activities would be limited to overlapping with critical habitat designated in the Hudson, Delaware, and James rivers for the New York Bight and Chesapeake Bay DPSs respectively, the conclusions reached here apply to critical habitat designated for all five DPSs.

The PDCs include a seasonal prohibition on any geophysical and geotechnical survey activities involving disturbance of the bottom in freshwater (salinity less than 0.5 parts per thousand (ppt)) areas designated as critical habitat for any DPS of Atlantic sturgeon (see PDC # 2 for more detail). The PDCs also require operation of vessels in a way that ensures that vessel activities do not result in disturbance of bottom habitat.

In order to determine if the proposed action may affect critical habitat, we consider whether it would impact the habitat in a way that would affect its ability to support reproduction and recruitment. Specifically, we consider the effects of the action on the physical features of the proposed critical habitat. The Physical and Biological Features (PBFs) essential for Atlantic sturgeon conservation identified in the final rule (82 FR 39160) are:

> (1) Hard bottom substrate (e.g., rock, cobble, gravel, limestone, boulder, etc.) in low salinity waters (i.e., 0.0 to 0.5 ppt range) for settlement of fertilized eggs, refuge, growth, and development of early life stages;
>
> (2) Aquatic habitat with a gradual downstream salinity gradient of 0.5 up to as high as 30 ppt and soft substrate (e.g., sand, mud) between the river mouth and spawning sites for juvenile foraging and physiological development;
>
> (3) Water of appropriate depth and absent physical barriers to passage (e.g., locks, dams, thermal plumes, turbidity, sound, reservoirs, gear, etc.) between the river mouth and spawning sites necessary to support: (i) Unimpeded movement of adults to and from spawning sites; (ii) Seasonal and physiologically dependent movement of juvenile Atlantic sturgeon to appropriate salinity zones within the river estuary; and, (iii) Staging, resting, or holding of subadults or spawning condition adults. Water depths in main river channels must also be deep enough (e.g., at least 1.2 m) to ensure continuous flow in the main channel at all times when any sturgeon life stage would be in the river.
>
> (4) Water, between the river mouth and spawning sites, especially in the bottom meter of the water column, with the temperature, salinity, and oxygen values that, combined, support: (i) Spawning; (ii) Annual and interannual adult, subadult, larval, and juvenile survival; and, (iii) Larval, juvenile, and subadult growth, development, and recruitment (e.g., 13 degrees Celsius [°C] to 26 °C for spawning habitat and no more than 30 °C for juvenile rearing habitat, and 6 milligrams per liter (mg/L) dissolved oxygen (DO) or greater for juvenile rearing habitat).

PBF 1: Hard bottom substrate (e.g., rock, cobble, gravel, limestone, boulder, etc.) in low salinity waters (i.e., 0.0–0.5 ppt range) for settlement of fertilized eggs, refuge, growth, and development of early life stages

In considering effects to PBF 1, we consider whether the proposed action will have any effect on areas of hard substrate in low salinity waters that may be used for settlement of fertilized eggs, refuge, growth, and development of early life stages; therefore, we consider effects of the action on hard bottom substrate and any change in the value of this feature in the action area.

Vessel operations during transits or surveys would not affect hard bottom habitat in the part of the river with salinity less than 0.5 ppt, because they would not impact the river bottom in any way or change the salinity of portions of the river where hard bottom is found. Similarly, geophysical surveys use acoustics to accurately map the seafloor, which would not impact any hard bottom that is present.

Grab samples, geotechnical surveys, and any other activity that may affect hard bottom is prohibited in areas with salinity less than 0.5 ppt during the time of year that these areas may be used for spawning or rearing (PDC 2). Given the very small footprint of all survey activities that may affect the hard bottom (3-4 inch diameter area would be disturbed during sampling) and the spacing of sampling several hundred meters apart, any effects to hard bottom substrate from survey activities outside of the time of year when these areas may be used for spawning and rearing would be small, localized, and dispersed. Given the dynamic nature of river sediments and the small area that will be disturbed, we expect that substrate conditions will recover to pre-survey conditions within days to weeks of sampling occurring. As such, any effects to hard bottom substrate and the value of this feature in the action area or to any of the critical habitat units as a whole are temporary and so small that they cannot be meaningfully measured, evaluated, or detected and, therefore, are insignificant.

PBF 2: Aquatic habitat with a gradual downstream salinity gradient of 0.5 up to as high as 30 ppt and soft substrate (e.g., sand, mud) between the river mouth and spawning sites for juvenile foraging and physiological development

In considering effects to PBF 2, we consider whether the proposed action will have any effect on areas of soft substrate within transitional salinity zones between the river mouth and spawning sites for juvenile foraging and physiological development; therefore, we consider effects of the action on soft substrate and salinity and any change in the value of this feature in the action area.

Project vessels (whether transiting or surveying) do not have the potential to effect salinity. Vessels are expected to maintain a minimum of 4-feet clearance with the river bottom (see PDC 2) and, therefore, effects to the soft substrate are extremely unlikely. The vessels' operations would not preclude or significantly delay the development of soft bottom habitat in the transitional salinity zone because they would not impact salinity or the river bottom in any way. Similarly, geophysical surveys use acoustics to accurately map the bottom, which would not affect any soft substrate that is present.

Grab samples and geotechnical surveys may impact soft substrate; however, given the very small footprint of any such activities (3-4 inch diameter area would be disturbed during sampling) and the spacing of sampling locations several hundred meters apart, any effects to soft substrate would be small, localized, and dispersed. Given the dynamic nature of river sediments and the small area that will be disturbed, we expect that substrate conditions will recover to pre-survey conditions within days to weeks of sampling occurring. As such, any effects to soft substrate and the value of this feature in the action area, are extremely unlikely or so small that they cannot be meaningfully measured, evaluated, or detected.

PBF 3: Water absent physical barriers to passage between the river mouth and spawning sites

In considering effects to PBF 3, we consider whether the proposed action will have any effect on water of appropriate depth and absent physical barriers to passage (e.g., locks, dams, thermal plumes, turbidity, sound, reservoirs, gear, etc.) between the river mouth and spawning sites necessary to support: unimpeded movements of adults to and from spawning sites; seasonal and physiologically dependent movement of juvenile Atlantic sturgeon to appropriate salinity zones within the river estuary, and; staging, resting, or holding of subadults or spawning condition adults. We also consider whether the proposed action will affect water depth or water flow, as if water is too shallow it can be a barrier to sturgeon movements, and an alteration in water flow could similarly impact the movements of sturgeon in the river, particularly early life stages that are dependent on downstream drift. Therefore, we consider effects of the action on water depth and water flow and whether the action results in barriers to passage that impede the movements of Atlantic sturgeon.

Survey activities, including vessel transits, will have no effect on this feature as they will not have any effect on water depth or water flow and will not be physical barriers to passage for any life stage of Atlantic sturgeon that may occur in this portion of the action area. As explained above, noise associated with the geotechnical surveys is below the threshold that would be expected to result in any disturbance of sturgeon; therefore, noise associated with geotechnical surveys will not affect the habitat in any way that would affect the movement of Atlantic sturgeon. Similarly, while HRG surveys may affect the movement of individual sturgeon, the effects are short-term and transient; noise is not expected to result in a barrier to passage. Based on this analysis, any effects to PBF 3 will be insignificant.

PBF 4: Water with the temperature, salinity, and oxygen values that, combined, provide for DO values that support successful reproduction and recruitment and are within the temperature range that supports the habitat function

In considering effects to PBF 4, we consider whether the proposed action will have any effect on water, between the river mouth and spawning sites, especially in the bottom meter of the water column, with the temperature, salinity, and oxygen values that, combined, support: spawning; annual and interannual adult, subadult, larval, and juvenile survival; and larval, juvenile, and subadult growth, development, and recruitment. Therefore, we consider effects of the action on temperature, salinity and DO needs for Atlantic sturgeon spawning and recruitment. These water quality conditions are interactive and both temperature and salinity influence the DO saturation for a particular area. We also consider whether the action will have effects to access to this feature, temporarily or permanently and consider the effect of the action on the action area's ability to develop the feature over time. Survey activities, including vessel transit, will have no effect on this feature as they will not have any effect on temperature, salinity or dissolved oxygen.

Summary of effects to Atlantic sturgeon critical habitat
We have determined that the effects of the activities considered here will be insignificant on PBFs 1, 2, and 3, and will have no effects to PBF 4. As such, the activities considered here are not likely to adversely affect Atlantic sturgeon critical habitat designated for any of the five DPSs.

Critical Habitat Designated for the Northwest Atlantic Ocean DPS of Loggerhead Sea Turtles
Critical habitat for the Northwest Atlantic Ocean DPS of loggerhead sea turtles was designated in 2014 (79 FR 39855). Specific areas for designation include 38 occupied marine areas within the range of the Northwest Atlantic Ocean DPS. These areas contain one or a combination of habitat

types: Nearshore reproductive habitat, winter area, breeding areas, constricted migratory corridors, and/or *Sargassum* habitat. There is no critical habitat designated in the North Atlantic Renewable Energy Region. Winter, breeding, and migratory habitat occur in the Mid-Atlantic and South Atlantic regions of the action areas; there is also a small amount of overlap with *Sargassum* critical habitat on the outer edges of the action area near the 100-m isobaths. Geophysical and geotechnical surveys and met buoy deployment may take place within this critical habitat. As explained below, the activities considered in this programmatic consultation are not likely to adversely affect critical habitat designated for the Northwest Atlantic Ocean DPS of loggerheads.

Nearshore Reproductive
The PBF of nearshore reproductive habitat is described as a portion of the nearshore waters adjacent to nesting beaches that are used by hatchlings to egress to the open-water environment as well as by nesting females to transit between beach and open water during the nesting season. The occurrence of designated nearshore reproductive habitat in the action area is limited to the area between the beach to 1 mile offshore along the Atlantic coast from Cape Hatteras, North Carolina to the southern extent of the South Atlantic planning area along the Florida coast.

As described in the final rule, the primary constituent elements (PCE) that support this habitat are the following: (1) Nearshore waters directly off the highest density nesting beaches and their adjacent beaches as identified in 50 CFR 17.95(c) to 1.6 km (1 mile) offshore; (2) Waters sufficiently free of obstructions or artificial lighting to allow transit through the surf zone and outward toward open water; and, (3) Waters with minimal manmade structures that could promote predators (i.e., nearshore predator concentration caused by submerged and emergent offshore structures), disrupt wave patterns necessary for orientation, and/or create excessive longshore currents.

Met buoys will only be deployed in federal waters; therefore, no met buoys will be deployed in nearshore reproductive habitat. HRG and geotechnical surveys and associated vessel transits could occur in this nearshore habitat. The intermittent noise associated with these activities will not be an obstruction to turtles moving through the surf zone; this is because the noise that can be perceived by sea turtles would dissipate to non-disturbing levels within 90 m of the moving source (see further explanation above) and the area with potentially disturbing levels of noise would be limited to one area within 90 m of the source at any given time. Therefore, given the small geographic area affected by noise and that these effects will be temporary (experienced for no more than 2 minutes in any given area), the effects to habitat are insignificant. Any lighting associated with the surveys would be limited to lights on vessels in the ocean, this lighting would not disorient turtles the way that artificial lighting along land can. Additionally, there are no mechanisms by which the HRG and geotechnical surveys and vessel activities would promote predators or disrupt wave patterns necessary for orientation or create excessive longshore currents.

Winter
The PBF of winter habitat is described as warm water habitat south of Cape Hatteras, North Carolina near the western edge of the Gulf Stream used by a high concentration of juveniles and adults during the winter months. The one area of winter critical habitat identified in the final rule extends from Cape Hatteras at the 20 m depth contour straight across 35.27° N. lat. to the 100 m (328 ft.) depth contour, south to Cape Fear at the 20 m (66 ft.) depth contour (approximately

33.47° N. lat., 77.58° W. long.) extending in a diagonal line to the 100 m (328 ft.) depth contour (approximately 33.2° N. lat., 77.32° W. long.). This southern diagonal line (in lieu of a straight latitudinal line) was chosen to encompass the loggerhead concentration area (observed in satellite telemetry data) and identified habitat features, while excluding the less appropriate habitat (e.g., nearshore waters at 33.2° N. lat.). PCEs that support this habitat are the following: (1) Water temperatures above 10°C from November through April; (2) Continental shelf waters in proximity to the western boundary of the Gulf Stream; and, (3) Water depths between 20 and 100 m.

Met buoy deployment/operation, HRG and geotechnical surveys, and vessel transits that may occur within the designated winter habitat will have no effect on this habitat because they will not: affect or change water temperatures above 10° C from November through April; affect continental shelf waters in proximity to the western boundary of the Gulf Stream; or, affect or change water depths between 20 and 100 m.

Breeding

The PBFs of concentrated breeding habitat are sites with high densities of both male and female adult individuals during the breeding season. Two units of breeding critical habitat are identified in the final rule. One occurs in the action area – a concentrated breeding site located in the nearshore waters just south of Cape Canaveral, Florida. The PCEs that support this habitat are the following: (1) High densities of reproductive male and female loggerheads; (2) Proximity to primary Florida migratory corridor; and, (3) Proximity to Florida nesting grounds.

Met buoys, HRG and geotechnical surveys, and vessel transits will not affect the habitat in the breeding units in a way that would change the density of reproductive male or female loggerheads. This is because (as explained fully above), any effects to distribution of sea turtles will be limited to intermittent, temporary disturbance limited to avoidance of an area no more than 90m from the survey vessel. The impacts to habitat from temporary increases in noise will be so small that they will be insignificant.

Constricted Migratory Corridors

The PBF of constricted migratory habitat is high use migratory corridors that are constricted (limited in width) by land on one side and the edge of the continental shelf and Gulf Stream on the other side. The final rule describes two units of constricted migratory corridor habitat. The constricted migratory corridor off North Carolina serves as a concentrated migratory pathway for loggerheads transiting to neritic foraging areas in the north, and back to winter, foraging, and/or nesting areas in the south. The constricted migratory corridor in Florida stretches from the westernmost edge of the Marquesas Keys (82.17° W. long.) to the tip of Cape Canaveral (28.46° N. lat.) and partially overlaps with the action area (i.e., the designated habitat extends further south than the action area). PCEs that support this habitat are the following: (1) Constricted continental shelf area relative to nearby continental shelf waters that concentrate migratory pathways; and, (2) Passage conditions to allow for migration to and from nesting, breeding, and/or foraging areas.

Noise associated with the survey activities considered here will have minor and temporary effects on winter habitat; however, as explained fully above, any effects to sea turtles will be limited to intermittent, temporary disturbance or avoidance of an area no more than 90m from the survey vessel. These temporary and intermittent increases in underwater noise will have insignificant effects on the conditions of the habitat that will not result in any decreased ability or availability of habitat for passage of sea turtles. No other activities will affect passage of loggerhead sea turtles in the wintering habitat.

Sargassum

The PBF of loggerhead *Sargassum* habitat is developmental and foraging habitat for young loggerheads where surface waters form accumulations of floating material, especially *Sargassum*. Two areas are identified in the final rule – the Atlantic Ocean area and the Gulf of Mexico area. The Atlantic Ocean area extends from the Gulf of Mexico along the northern/western boundary of the Gulf Stream and east to the outer edge of the U.S. EEZ. There is a small amount of overlap between the action area and the Atlantic Ocean *Sargassum* critical habitat unit on the outer edges of the action area near the 100-m isobaths. PCEs that support this habitat are the following: (i) Convergence zones, surface-water downwelling areas, the margins of major boundary currents (Gulf Stream), and other locations where there are concentrated components of the *Sargassum* community in water temperatures suitable for the optimal growth of *Sargassum* and inhabitance of loggerheads; (ii) *Sargassum* in concentrations that support adequate prey abundance and cover; (iii) Available prey and other material associated with *Sargassum* habitat including, but not limited to, plants and cyanobacteria and animals native to the *Sargassum* community such as hydroids and copepods; and, (iv) Sufficient water depth and proximity to available currents to ensure offshore transport (out of the surf zone), and foraging and cover requirements by *Sargassum* for post-hatchling loggerheads, i.e., >10 m depth.

Given the distance from shore, met buoy deployment is not anticipated in areas designated as *Sargassum* critical habitat. The occasional project vessel transits, HRG and geotechnical surveys that may occur within the designated *Sargassum* habitat will have no effect on: conditions that result in convergence zones, surface-water downwelling areas, the margins of major boundary currents (Gulf Stream), and other locations where there are concentrated components of the *Sargassum* community in water temperatures suitable for the optimal growth of *Sargassum* and inhabitance of loggerheads; the concentration of *Sargassum*; the availability of prey within *Sargassum*; or the depth of water in any area. This is because these activities do not affect hydrological or oceanographic processes, no *Sargassum* will be removed due to survey activities, and the intermittent noise associated with surveys will not affect the availability of prey within *Sargassum*.

Summary of effects to critical habitat

Any effects to designated critical habitat will be insignificant. Therefore, the survey activities considered in this programmatic consultation are not likely to adversely affect critical habitat designated for the Northwest Atlantic DPS of loggerhead sea turtles.

Vessel Traffic

The HRG and geotechnical surveys are carried out from vessels. Additionally, vessels will be used to transport met buoys to and from deployment sites and to carry out any necessary inspections. As described in BOEM’s BA, survey operations involve slow moving vessels, traveling at no more than 3-4.5 knots. HRG and geotechnical surveys typically involve one to three survey vessels operating within the area to be surveyed; up to approximately 36 areas may be surveyed over the 10-year period considered here. During transits to or from survey locations, these vessels would travel at a maximum speed of around 12 knots. Met buoy deployment, retrieval, and inspection will also involve one or two vessels at a time; a total of 60 buoys are considered in this consultation. These vessels will typically travel at speeds of 12 knots or less; however, service vessels (limited to one trip per month per buoy) may travel at speeds of up to 25 knots (BOEM 2021).

Marine Mammals

As detailed in Appendix B, a number of Best Management Practices (BMPs) (see PDC 5), designed to reduce the risk of vessel strike, will be implemented for all activities covered by this programmatic consultation, including the following requirements:

1. All vessel operators and crews will maintain a vigilant watch for marine mammals at all times, and slow down or stop their vessel to avoid any interaction.
2. PSOs monitoring a Vessel Strike Avoidance Zone during all vessel operations.
3. Complying with speed restrictions in North Atlantic right whale management areas including Seasonal Management Areas (SMAs), active Dynamic Management Areas (DMAs)/visually triggered Slow Zones.
4. Daily monitoring of the NMFS North Atlantic right whale reporting systems.
5. Reducing vessel speeds to ≤10 knots when mother/calf pairs, pods, or large assemblages of ESA-listed marine mammals are observed.
6. Maintaining >500 m separation distance from all ESA-listed whales or an unidentified large marine mammal; if a whale is sighted within 200 m of the forward path of the vessel, then reducing speed and shifting the engines into neutral, and must not be engaged until the whale has move outside of the vessel's path and beyond 500 m.

An examination of all known ship strikes from all shipping sources (civilian and military) indicates vessel speed is a principal factor in whether a vessel strike results in death of a whale (Kelley et al. 2020; Knowlton and Kraus 2001; Laist et al., 2001; Jensen and Silber 2003; Vanderlaan and Taggart 2007). In assessing records with known vessel speeds, Laist et al. (2001) found a direct relationship between the occurrence of a whale strike and the speed of the vessel involved in the collision. The authors concluded that most deaths occurred when a vessel was traveling in excess of 24.1 km/h (14.9 mph; 13 knots (kn)). Additionally, Kelley et al (2020) found that collisions that create stresses in excess of 0.241 megapascals were likely to cause lethal injuries to large whales and through biophysical modeling that vessels of all sizes can yield stresses higher than this critical level. Survey vessels will typically travel slowly (less than 4.5 knots) as necessary for data acquisition, will have PSOs monitoring for whales, and will adjust vessel operations as necessary to avoid striking whales during survey operations and transits. The only times that survey vessels will operate at speeds above 4 knots is during transit to and from the survey site where they may travel at speeds up to 12 knots (although several circumstances described below will restrict speed to 10 knots), a number of measures (see PDC 5) will be in place to minimize the risk of strike during these transits. Slow operating speeds mean that vessel operators have more time to react and steer the vessel away from a whale. The use of dedicated PSOs to keep a constant watch for whales and to alert vessel operators of any sightings also allows vessel operators to avoid striking any sighted whales.

As noted above, vessels used to inspect and maintain met buoys may travel at speeds up to 25 knots. This vessel traffic will be an extremely small increase in the amount of vessel traffic in the action area (i.e., if 60 buoys are deployed this would be a maximum of 60 trips per month spread out along the entire Atlantic OCS), which is transited by thousands of vessels each day. These vessels are subject to all of the vessel related BMPs (see PDC 5) noted above, including use of a dedicated lookout, vessel strike avoidance procedures, and requirements to slow down to 10 knots in areas where North Atlantic right whales have been documented (i.e., within SMAs, DMAs/visually triggered Slow Zones). Based on this analysis, it is extremely unlikely that a vessel associated with the survey activities considered here, when added to the environmental baseline, will strike an ESA-listed whale. We note that similar activities have taken place since at least 2012 in association with BOEM's renewable energy program and there have been no reports of any vessel strikes of marine mammals.

The frequency range for vessel noise (10 to 1000 Hz; MMS 2007) overlaps with the generalized hearing range for sei, fin, and right whales (7 Hz to 35 kHz) and sperm whales (150 Hz to 160 kHz) and would therefore be audible. Vessels without ducted propeller thrusters would produce levels of noise of 150 to 170 dB re 1 μPa-1 meter at frequencies below 1,000 Hz, while the expected sound-source level for vessels with ducted propeller thrusters level is 177 dB (RMS) at 1 meter (BOEM 2015, Rudd et al. 2015). For ROVs, source levels may be as high as 160 dB (BOEM 2021). Given that the noise associated with the operation of project vessels is below the thresholds that could result in injury, no injury is expected.

Marine mammals may experience masking due to vessel noises. For example, right whales were observed to shift the frequency content of their calls upward while reducing the rate of calling in areas of increased anthropogenic noise (Parks et al. 2007) as well as increasing the amplitude (intensity) of their calls (Parks et al. 2011a; Parks et al. 2009). Right whales also had their communication space reduced by up to 84 percent in the presence of vessels (Clark et al. 2009). Although humpback whales did not change the frequency or duration of their vocalizations in the presence of ship noise, their source levels were lower than expected, potentially indicating some signal masking (Dunlop 2016).

Vessel noise can potentially mask vocalizations and other biologically important sounds (e.g., sounds of prey or predators) that marine mammals may rely on. Potential masking can vary depending on the ambient noise level within the environment, the received level and frequency of the vessel noise, and the received level and frequency of the sound of biological interest. In the open ocean, ambient noise levels are between about 60 and 80 dB re 1 µPa in the band between 10 Hz and 10 kHz due to a combination of natural (e.g., wind) and anthropogenic sources (Urick 1983), while inshore noise levels, especially around busy ports, can exceed 120 dB re 1 µPa. When the noise level is above the sound of interest, and in a similar frequency band, masking could occur. This analysis assumes that any sound that is above ambient noise levels and within an animal's hearing range may potentially cause masking. However, the degree of masking increases with increasing noise levels; a noise that is just detectable over ambient levels is unlikely to cause any substantial masking.

Vessel noise has the potential to disturb marine mammals and elicit an alerting, avoidance, or other behavioral reaction. These reactions are anticipated to be short-term, likely lasting the amount of time the vessel and the whale are in close proximity (e.g., Magalhaes et al. 2002; Richardson et al. 1995; Watkins 1981), and not consequential to the animals. Additionally, short-term masking could occur. Masking by passing ships or other sound sources transiting the action area would be short term and intermittent, and therefore unlikely to result in any substantial costs or consequences to individual animals or populations. Areas with increased levels of ambient noise from anthropogenic noise sources such as areas around busy shipping lanes and near harbors and ports may cause sustained levels of masking for marine mammals, which could reduce an animal's ability to find prey, find mates, socialize, avoid predators, or navigate.

Based on the best available information, ESA-listed whales are either not likely to respond to vessel noise or are not likely to measurably respond in ways that would significantly disrupt normal behavior patterns that include, but are not limited to, breeding, feeding or sheltering. Therefore, the effects of vessel noise on ESA-listed whales are insignificant (i.e., so minor that the effect cannot be meaningfully evaluated or detected).

Sea Turtles

As detailed in Appendix B, a number of BMPs (see PDC 5), designed to reduce the risk of vessel strike, will be implemented for all activities covered by this programmatic consultation, including dedicated lookouts on board all transiting vessels, reduced speeds and avoidance of areas where sea turtles are likely to occur (e.g., Sargassum patches), and required separation distances from any observed sea turtles.

Sea turtles are vulnerable to vessel collisions because they regularly surface to breathe and often rest at or near the surface. Sea turtles often congregate close to shorelines during the breeding season, where boat traffic is denser (Schofield et al. 2007; Schofield et al. 2010) which can increase vulnerability to vessel strike in such areas, particularly by smaller, fast moving vessels. Sea turtles, with the exception of hatchlings and pre-recruitment juveniles, spend a majority of their time submerged (Renaud and Carpenter 1994; Sasso and Witzell 2006). Although, Hazel et al. (2007) demonstrated sea turtles preferred to stay within the three meters of the water's surface, despite deeper water being available. Any of the sea turtle species found in the action area can occur at or near the surface in open-ocean and coastal areas, whether resting, feeding or periodically surfacing to breathe.

While research is limited on the relationship between sea turtles, vessel strikes and vessel speeds, sea turtles are at risk of vessel strike where they co-occur with vessels. Sea turtle detection is likely based primarily on the animal's ability to see the oncoming vessel, which would provide less time to react to vessels traveling at speeds at or above 10 knots (Hazel et al. 2007). Hazel et al. (2007) examined vessel strike risk to green sea turtles and suggested that sea turtles may habituate to vessel sound and are more likely to respond to the sight of a vessel rather than the sound of a vessel, although both may play a role in eliciting responses (Hazel et al. 2007). Regardless of what specific stressor associated with vessels turtles are responding, they only appear to show responses (avoidance behavior) at approximately 10 m or closer (Hazel et al. 2007). This is a concern because faster vessel speeds also have the potential to result in more serious injuries (Work et al. 2010). Although sea turtles can move quickly, Hazel et al. (2007) concluded that at vessel speeds above 4 km/hour (2.1 knots) vessel operators cannot rely on turtles to actively avoid being struck. Thus, sea turtles are not considered reliably capable of moving out of the way of vessels moving at speeds greater than 2.1 knots.

While vessel struck sea turtles have been observed throughout their range, including in the action area, the regions of greatest concern for vessel strike are areas with high concentrations of recreational-boat traffic such as the eastern Florida coast, the Florida Keys, and the shallow coastal bays in the Gulf of Mexico (NRC 1990). In general, the risk of strike for sea turtles is considered to be greatest in areas with high densities of sea turtles and small, fast moving vessels such as recreational vessels or speed boats (NRC 1990). Similarly, Foley et al. (2019) concluded that in a study in Florida, vessel strike risk for sea turtles was highest at inlets and passes. Stetzar (2002) reports that 24 of 67 sea turtles stranded along the Atlantic Delaware coast from 1994-1999 had evidence of boat interactions (hull or propeller strike); however, it is unknown how many of these strikes occurred after the sea turtle died. There are no estimates of the total number of sea turtles struck by vessels in the Atlantic Ocean each year. Foley et al. (2019), estimated that strikes by motorized watercraft killed a mean of 1,326–4,334 sea turtles each year in Florida during 2000–2014 (considering the Atlantic and Gulf coasts of Florida). As described in NRC 1990, vessel strike risk for sea turtles in the Atlantic Ocean is highest in Florida.

The proposed survey activities will result in an increase in vessel traffic in the action area. Compared to baseline levels of vessel traffic in the action area (in its entirety and in any particular portion), the survey vessels, which will be likely two or three vessels operating in a particular survey area at a time (and spaced such that the sound fields of any noise producing equipment do not overlap), represent an extremely small fraction of total vessel traffic. For example, the U.S. Coast Guard's Atlantic Coast Port Access Route Study (ACPARS; USCG 2015), reports nearly 36,000 unique vessel transits through wind energy areas and lease areas along the Atlantic Coast. Those vessel transits represent only a fraction of the total coastal traffic as the wind energy areas and lease areas are located further offshore than most of the routes used by coastal tug traffic, for example. The U.S. Coast Guard's New Jersey PARS (USCG 2021) reports between 77,000 and 80,000 unique trips annual in the Atlantic Ocean off a portion of the coast of New Jersey in 2017-2019. This data is not wholly representative of all vessel traffic in this area as it only includes vessels carrying AIS systems, which is only required for vessels 65 feet in length or greater (although smaller vessels can utilize AIS and some do). Even if there were 3-boat surveys occurring in each of the four lease areas located in the New Jersey PARS study area, this would represent an increase of 12 vessels off New Jersey in a single year; this represents an approximately 0.01% increase in vessel traffic in that area. We expect that this increase is similar in other portions of the action area. If we assume that any increase in vessel traffic in the action area would increase the risk of vessel strike to sea turtles, then we could also assume that this would result in a corresponding increase in the number of sea turtles struck by vessels. However, it is unlikely that all vessels represent an equal increase in risk and the slow speeds (up to 4.5 knots) that the majority of vessels considered here will typically be moving, requirements to monitor for sea turtles during vessel transits, avoid or slowdown in areas where sea turtles are likely to occur, and to maintain distance from any sighted turtles, means that the risk to sea turtles from the survey vessels is considerably less than other vessels, particularly small, fast vessels operating in nearshore areas where sea turtle densities are high.

An analysis conducted by NMFS Southeast Regional Office (Barnette 2018) considered sea turtle vessel strike risk in Florida; the portion of the action area where risk is considered highest due to the concentration of sea turtles and vessels. Barnette (2018) concluded that, when using the conservative mean estimate of a sea turtle strike every 193 years (range of 135-250 years) per vessel, it would require approximately 200 new vessels introduced to an area to potentially result in a single sea turtle strike in any single year. Considering that the proposed action will introduce significantly fewer vessels in any particular area and that survey vessels will increase vessel traffic in the action area by less than 0.01%, and the measures that will be in place to reduce risk of vessel strike, as well as the slow speed of the survey vessels, we conclude that any increase in the number of sea turtles struck in the action area because of the increase in traffic resulting from survey vessels added to the environmental baseline is extremely unlikely. Therefore, effects of this increase in traffic are extremely unlikely.

The vessels used for the proposed project will produce low-frequency, broadband underwater sound below 1 kHz (for larger vessels), and higher-frequency sound between 1 kHz to 50 kHz (for smaller vessels), although the exact level of sound produced varies by vessel type.

ESA-listed turtles could be exposed to a range of vessel noises within their hearing abilities. Depending on the context of exposure, potential responses of green, Kemp's ridley, leatherback, and loggerhead sea turtles to vessel noise disturbance, would include startle responses, avoidance, or other behavioral reactions, and physiological stress responses. Very little research exists on sea turtle responses to vessel noise disturbance. Currently, there is nothing in the available literature specifically aimed at studying and quantifying sea turtle response to vessel noise. However, a study examining vessel strike risk to green sea turtles suggested that sea turtles may habituate to vessel sound and may be more likely to respond to the sight of a vessel rather than the sound of a vessel, although both may play a role in prompting reactions (Hazel et al. 2007). Regardless of the specific stressor associated with vessels to which turtles are responding, they only appear to show responses (avoidance behavior) at approximately 10 m or closer (Hazel et al. 2007).

Therefore, the noise from vessels is not likely to affect sea turtles from further distances, and disturbance may only occur if a sea turtle hears a vessel nearby or sees it as it approaches. These responses appear limited to non-injurious, minor changes in behavior based on the limited information available on sea turtle response to vessel noise.

For these reasons, vessel noise is expected to cause minimal disturbance to sea turtles. If a sea turtle detects a vessel and avoids it or has a stress response from the noise disturbance, these responses are expected to be temporary and only endure while the vessel transits through the area where the sea turtle encountered it. Therefore, sea turtle responses to vessel noise disturbance are considered insignificant (i.e., so minor that the effect cannot be meaningfully evaluated), and a sea turtle would be expected to return to normal behaviors and stress levels shortly after the vessel passes by.

Marine Fish

The only listed fish in the action area that are known to be at risk of vessel strike are shortnose and Atlantic sturgeon and giant manta ray. Vessel activities will have no effect on Atlantic salmon or smalltooth sawfish. There is no information to indicate that Atlantic salmon are struck by vessels; therefore, we have concluded that strike is extremely unlikely to occur. A vessel strike to smalltooth sawfish is extremely unlikely; smalltooth sawfish are primarily demersal and rarely would be at risk from moving vessels. PDC 5 requires vessels to maintain sufficient clearance above the bottom and to reduce speeds to 5 knots or less in waters with less than 4 feet of clearance. These conditions, combined with the low likelihood of vessels operating in nearshore coastal waters of Florida where sawfish occur, is expected to eliminate risk of vessel strikes with smalltooth sawfish.

Giant Manta Ray
Giant manta rays can be frequently observed traveling just below the surface and will often approach or show little fear toward humans or vessels (Coles 1916), which may also make them vulnerable to vessel strikes (Deakos 2010); vessel strikes can injure or kill giant manta rays, decreasing fitness or contributing to non-natural mortality (Couturier et al. 2012; Deakos et al. 2011). However, information about interactions between vessels and giant manta rays is limited. We have at least some reports of vessel strike, including a report of five giant manta rays struck by vessels from 2016 through 2018; individuals had injuries (i.e., fresh or healed dorsal surface propeller scars) consistent with a vessel strike. These interactions were observed by researchers conducting surveys from Boynton Beach to Jupiter, Florida (J. Pate, Florida Manta Project, pers. comm. to M. Miller, NMFS OPR, 2018) and it is unknown where the manta was at the time of the vessel strike. The giant manta ray is frequently observed in nearshore coastal waters and feeding at inlets along the east coast of Florida. As recreational vessel traffic is concentrated in and around inlets and nearshore waters, this overlap exposes the giant manta ray in these locations to an increased likelihood of potential vessel strike injury especially from faster moving recreational vessels. Yet, few instances of confirmed or suspected strandings of giant manta rays are attributed to vessel strike injury. This lack of documented mortalities could also be the result of other factors that influence carcass detection (i.e., wind, currents, scavenging, decomposition etc.); however, giant manta rays appear to be able to be fast and agile enough to avoid most moving vessels, as anecdotally evidenced by videos showing rays avoiding interactions with high-speed vessels.

While there is limited available information on the giant manta ray, we expect the circumstances and factors resulting in vessel strike injury are similar between sea turtles and the giant manta ray because these species are both found in nearshore waters (including in the vicinity of inlets where vessel traffic may also be concentrated) and may spend significant time at or near the surface. Therefore, consistent with Barnette 2018, we will rely on the more robust available data on sea turtle vessel strike injury to serve as a proxy for the giant manta ray. Because the activities considered here will result in far fewer than 200 new vessels, it is extremely unlikely that any giant manta rays will be struck by new or increased vessel traffic.

Sturgeon
Here, we consider whether the increase in vessel traffic is likely to increase the risk of strike for Atlantic or shortnose sturgeon in any part of the action area. Because the increase in traffic will be limited to no more than two or three survey vessels operating in an area being surveyed at one time, the increase in vessel traffic in any portion of the action area, as well as the action area as a whole, will be extremely small.

We do not expect shortnose sturgeon to occur along the survey routes in the Atlantic Ocean because coastal migrations are extremely rare. However, Atlantic sturgeon are present in this part of the action area. Both shortnose and Atlantic sturgeon may occur in nearshore waters and rivers and bays that may be surveyed for potential cable corridors and/or may be used for survey vessel transits to or from ports.

While we know that vessels and sturgeon co-occur in many portions of their range, we have no reports of vessel strikes outside of rivers and coastal bays. The risk of strike is expected to be considerably less in the Atlantic Ocean than in rivers. This is because of the greater water depth, lack of obstructions or constrictions and the more disperse nature of vessel traffic and more disperse distribution of individual sturgeon. All of these factors are expected to decrease the likelihood of an encounter between an individual sturgeon and a vessel and also increase the likelihood that a sturgeon would be able to avoid any vessel. While we cannot quantify the risk of vessel strike in the portions of the Atlantic Ocean that overlap with the action area, we expect the risk to be considerably lower than it is within the Delaware River, which is considered one of the areas with the highest risk of vessel strike for Atlantic sturgeon.

As evidenced by reports and collections of Atlantic and shortnose sturgeon with injuries consistent with vessel strike (NMFS unpublished data[8]), both species are struck and killed by vessels in the Delaware River. Brown and Murphy (2010) reported that from 2005-2008, 28 Atlantic sturgeon carcasses were collected in the Delaware River; approximately 50% showed signs of vessel interactions. Delaware Division of Fish and Wildlife has been recording information on suspected vessel strikes since 2005. From May 2005 – March 2016, they recorded a total of 164 carcasses, 44 of which were presumed to have a cause of death attributable to vessel interaction. Estimates indicate that up to 25 Atlantic sturgeon may be struck and killed in the Delaware River annually (Fox, unpublished 2016). Information on the number of shortnose sturgeon struck and killed by vessels in the Delaware River is currently limited to reports provided to NMFS through our sturgeon salvage permit. A review of the database indicates that of the 53 records of salvaged shortnose sturgeon (2008-2016), 11 were detected in the Delaware River. Of these 11, 6 had injuries consistent with vessel strike. This is considerably less than the number of records of Atlantic sturgeon from the Delaware River with injuries consistent with vessel strike (15 out of 33 over the same time period). Based on this, we assume that more Atlantic sturgeon are struck by vessels in the Delaware River than shortnose sturgeon.

Several major ports are present along the Delaware River. In 2014, there were 42,398 one-way trips reported for commercial vessels in the Delaware River Federal navigation channel (USACE 2014). In 2020, 2,195 cargo ships visited Delaware River ports[9]. Neither of these numbers include any recreational or other non-commercial vessels, ferries, tug boats assisting other larger vessels or any Department of Defense vessels (i.e., Navy, USCG, etc.).

If we assume that any increase in vessel traffic in the Delaware River would increase the risk of vessel strike to shortnose or Atlantic sturgeon, then we could also assume that this would result in

[8] The unpublished data are reports received by NMFS and recorded as part of the sturgeon salvage program authorized under ESA permit 17273.

[9] *https://ajot.com/news/maritime-exchange-reports-2020-ship-arrivals*; last accessed March 24, 2021

a corresponding increase in the number of sturgeon struck and killed in the Delaware River. However, it is unlikely that all vessels represent an equal increase in risk, the slow speeds (4.5 knots) and shallower drafts of the survey vessels may mean that the risk to sturgeon is not as greater as faster moving deep draft cargo or tanker vessels as sturgeon may be able to more readily avoid the survey vessels and may not even overlap in the same part of the water column. The survey activities considered here will involve up to three slow-moving (up to 4.5 knots) vessels operating in a similar area. Sets of survey vessels will be dispersed along the coast and not co-occur in time or space. Even if there were four surveys in a year that transited the Delaware River (equivalent to the number of BOEM leases that are proximal to the entrance of Delaware Bay), that would be an increase of 12 vessels annually. Considering only the number of commercial one way trips in a representative year (42,398), an increase of 12 vessels operating in the Delaware River represents an approximately 0.03% increase in vessel traffic in the Delaware River navigation channel in a particular year. The actual percent increase in vessel traffic is likely even less considering that commercial traffic is only a portion of the vessel traffic in the river. Even in a worst-case scenario that assumes that all 25 Atlantic sturgeon struck and killed in the Delaware River in an average year occurred in the portion of the Delaware River that will be transited by the survey vessels, and that any increase in vessel traffic results in a proportionate increase in vessel strikes, this increase in vessel traffic would result in a hypothetical additional 0.0075 Atlantic sturgeon struck and killed in the Delaware River in a given year. Assuming a maximum case that four, 3-boat surveys transit the Delaware River every year for the 10 years considered here, that would result in a hypothetical additional 0.075 Atlantic sturgeon struck and killed in the Delaware River. Because we expect fewer strikes of shortnose sturgeon, the hypothetical increase in the number of struck shortnose sturgeon would be even less. Given this very small increase in traffic and the similar very small potential increase in risk of strike and a calculated potential increase in the number of strikes that is very close to zero, we conclude that any increase in the number of sturgeon struck because of the increase in traffic resulting from survey vessels operating in the Delaware River or Delaware Bay is extremely unlikely. BOEM has indicated that survey vessels may also transit the lower Chesapeake Bay and New York Bight/lower Hudson River. The risk of vessel strike in these areas is considered to be lower than in the Delaware River; thus, any prediction of vessel strike for the Delaware River can be considered a conservative estimate of vessel strike risk in other areas. Even applying this hypothetical increased risk for all three areas, we would estimate that a hypothetical additional 0.2 Atlantic sturgeon would be killed coast-wide over a 10-year period. As noted above, this is likely an overestimate given the slower speed of survey vessels compared to other vessels which is anticipated to reduce risk. Based on this analysis, effects of this increase in traffic are extremely unlikely. In addition, given the very small increase in risk and the calculated increase in strikes is close to zero, the effect of adding the survey vessels to the baseline cannot be meaningfully measured, detected, or evaluated; therefore, effects are also insignificant.

Vessel Noise

The vessels used for the proposed project will produce low-frequency, broadband underwater sound below 1 kHz (for larger vessels), and higher-frequency sound between 1 kHz to 50 kHz (for smaller vessels), although the exact level of sound produced varies by vessel type. In general, information regarding the effects of vessel noise on fish hearing and behaviors is limited. Some TTS has been observed in fishes exposed to elevated background noise and other white noise, a continuous sound source similar to noise produced from vessels. Caged studies on sound pressure sensitive fishes show some TTS after several days or weeks of exposure to increased background sounds, although the hearing loss appeared to recover (e.g., Scholik and Yan 2002; Smith et al. 2006; Smith et al. 2004a). Smith et al. (2004b) and Smith et al. (2006) exposed goldfish (a fish with hearing specializations, unlike any of the ESA-listed species considered in this opinion) to noise with a sound pressure level of 170 dB re 1 μPa and found a clear relationship between the amount of TTS and duration of exposure, until maximum hearing loss occurred at about 24 hours of exposure. A short duration (e.g., 10-minute) exposure resulted in 5 dB of TTS, whereas a three-week exposure resulted in a 28 dB TTS that took over two weeks to return to pre-exposure baseline levels (Smith et al. 2004b). Recovery times were not measured by researchers for shorter exposure durations, so recovery time for lower levels of TTS was not documented.

Vessel noise may also affect fish behavior by causing them to startle, swim away from an occupied area, change swimming direction and speed, or alter schooling behavior (Engas et al. 1998; Engas et al. 1995; Mitson and Knudsen 2003). Physiological responses have also been documented for fish exposed to increased boat noise. Nichols et al. (2015) demonstrated physiological effects of increased noise (playback of boat noise) on coastal giant kelpfish. The fish exhibited acute stress responses when exposed to intermittent noise, but not to continuous noise. These results indicate variability in the acoustic environment may be more important than the period of noise exposure for inducing stress in fishes. However, other studies have also shown exposure to continuous or chronic vessel noise may elicit stress responses indicated by increased cortisol levels (Scholik and Yan 2001; Wysocki et al. 2006). These experiments demonstrate physiological and behavioral responses to various boat noises that have the potential to affect species' fitness and survival, but may also be influenced by the context and duration of exposure. It is important to note that most of these exposures were continuous, not intermittent, and the fish were unable to avoid the sound source for the duration of the experiment because this was a controlled study. In contrast, wild fish are not hindered from movement away from an irritating sound source, if detected, so are less likely to subjected to accumulation periods that lead to the onset of hearing damage as indicated in these studies. In other cases, fish may eventually become habituated to the changes in their soundscape and adjust to the ambient and background noises.

All fish species can detect vessel noise due to its low-frequency content and their hearing capabilities. Because of the characteristics of vessel noise, sound produced from vessels is unlikely to result in direct injury, hearing impairment, or other trauma to ESA-listed fish. Plus, in the near field, fish are able to detect water motion as well as visually locate an oncoming vessel. In these cases, most fishes located in close proximity that detect the vessel either visually, via sound and motion in the water would be capable of avoiding the vessel or move away from the area affected by vessel sound. Thus, fish are more likely to react to vessel noise at close range than to vessel noise emanating from a greater distance away. These reactions may include physiological stress responses, or avoidance behaviors. Auditory masking due to vessel noise can potentially mask biologically important sounds that fish may rely on. However, impacts from vessel noise would be intermittent, temporary, and localized, and such responses would not be expected to compromise the general health or condition of individual fish from continuous exposures. Instead, the only impacts expected from exposure to project vessel noise for Atlantic sturgeon may include temporary auditory masking, physiological stress, or minor changes in behavior.

Therefore, similar to marine mammals and sea turtles, exposure to vessel noise for fishes could result in short-term behavioral or physiological responses (e.g., avoidance, stress). Vessel noise would only result in brief periods of exposure for fishes and would not be expected to accumulate to the levels that would lead to any injury, hearing impairment or long-term masking of biologically relevant cues. For these reasons, any effects of vessel noise on ESA-listed fish is considered insignificant (i.e., so minor that the effect cannot be meaningfully measured, detected, or evaluated).

Consideration of Effects of the Actions on Air Quality

In order to issue an OCS Air Permit for an activity considered in this consultation, EPA must conclude that the activity will not cause or contribute to a violation of applicable national ambient air quality standards (NAAQS) or prevention of significant deterioration (PSD) increments. The NAAQS are health-based standards that the EPA sets to protect public health with an adequate margin of safety. The PSD increments are designed to ensure that air quality in an area that meets the NAAQS does not significantly deteriorate from baseline levels. At this time, there is no information on the effects of air quality on listed species that may occur in the action area. However, as the PSD increments are designed to ensure that air quality in the area regulated by any OCS Air Permit do not significantly deteriorate from baseline levels, we conclude that any effects to listed species from these emissions will be so small that they cannot be meaningfully measured, detected, or evaluated and therefore are insignificant.

CONCLUSIONS

As explained above, we have determined that the actions considered here are not likely to adversely affect any ESA-listed species or critical habitat. The requirements for reviewing survey activities as they are developed will ensure that surveys carried out under this programmatic consultation do not have effects that exceed those considered here.

Reinitiation of consultation is required and shall be requested by BOEM or by NMFS where discretionary federal involvement or control over the action has been retained or is authorized by law and "(a) If the amount or extent of taking specified in the incidental take statement is exceeded; (b) If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (c) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion; or (d) If a new species is listed or critical habitat designated that may be affected by the identified action." For the activities considered here, no take is anticipated or exempted; take is defined in the ESA as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct." If there is any incidental take of a listed species, reinitiation would be required. As required by the PDCs outlined in Appendix B, all observations of dead or injured listed species should be reported to us immediately.

Should you have any questions regarding this consultation, please contact Julie Crocker of my staff at (978) 282-8480 or by e-mail (*Julie.Crocker@noaa.gov*).

Sincerely,

Jennifer Anderson

Jennifer Anderson
Assistant Regional Administrator
for Protected Resources

ec: Hooker, Baker - BOEM
Burns - GARFO HSED
Bernhart - SERO
Harrison, Daly, Carduner - OPR
DOE
EPA
USACE

File Code: Sec 7 BOEM OSW site assessment programmatic (2021)
ECO ID: GARFO-2021-0999

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Appendix A – Tables and Figures

All Figures and Tables Reproduced from BOEM's February 2021 BA

Figure 1. Action Area for this programmatic consultation.

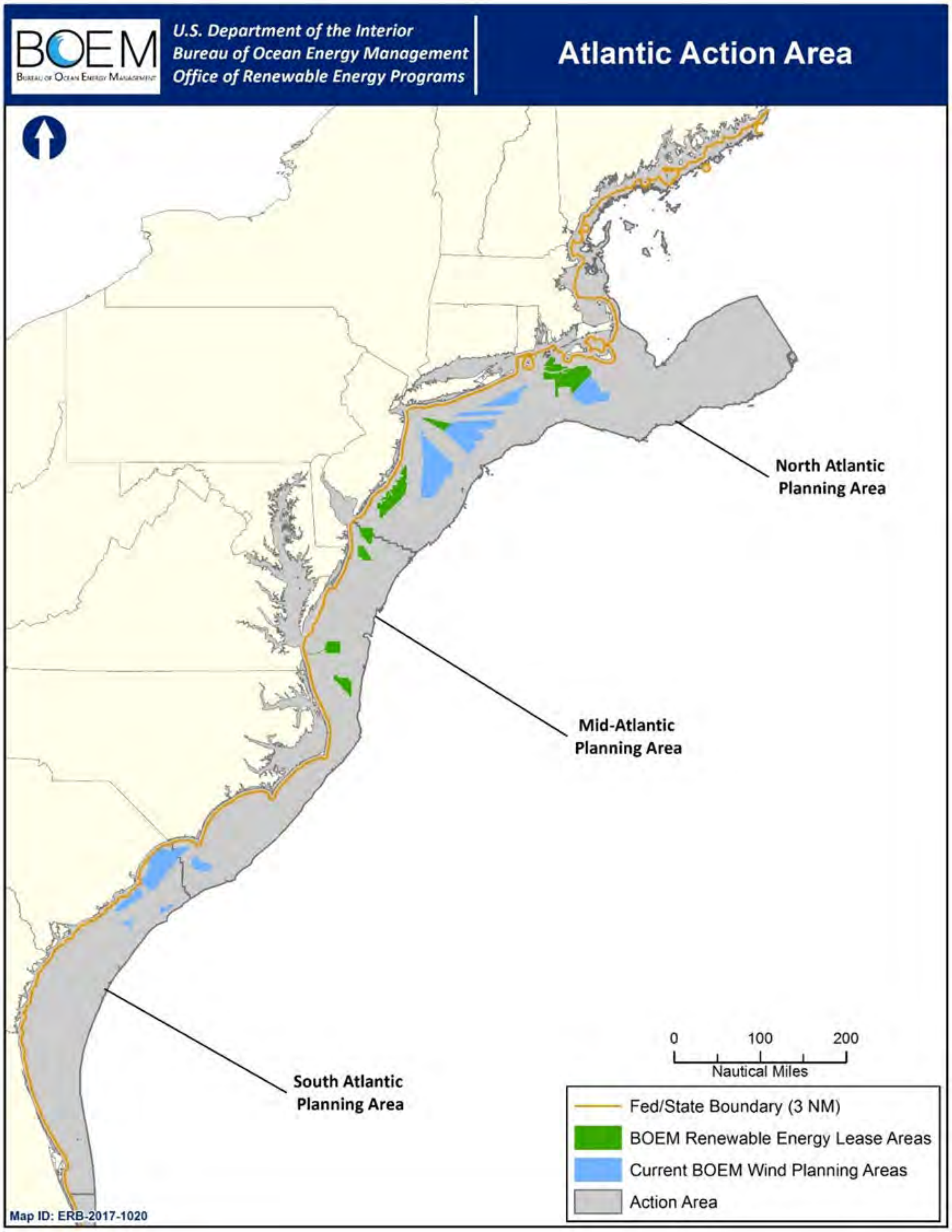

Table A.1 Description of Representative HRG Survey Equipment and Methods

Equipment Type	Data Collection and/or Survey Types	Description of the Equipment
Acoustic Corer™ (https://www.pangeosubsea.com/acoustic-corer/)	Stationary acoustic source deployed on the seafloor with low and mid frequency chirp sonars to detect shallow (15 m to 40 m) subsea hazards such as boulders, cavities, and abandoned infrastructure by generating a 3D, 12-m diameter "acoustic core" to full penetration depth (inset above).	A seabed deployed unit with dual subsurface scanning sonar heads attached to a 12-m boom. The system is set on a tripod on the seafloor. Each arm rotates 180 degrees to cover a full 360 degrees. Chirp sonars of different frequencies can be attached to each arm providing for multi-aspect depth resolution. Acoustic cores supplement geophysical surveys such as bore holes and Cone Penetration Testing.
Bathymetry/ multi-beam echosounder	Bathymetric charting	A depth sounder is a microprocessor-controlled, high-resolution survey-grade system that measures precise water depths in both digital and graphic formats. The system would be used in such a manner as to record with a sweep appropriate to the range of water depths expected in the survey area.
Magnetometer	Collection of geophysical data for shallow hazards and archaeological resources assessments	Surveys would be used to detect and aid in the identification of ferrous or other objects having a distinct magnetic signature. A sensor is typically towed as near as possible to the seafloor and anticipated to be no more than approximately 20 ft. (6 m) above the seafloor.
Shallow and Medium (Seismic) Penetration Profilers (i.e. Chirps, Sparkers, Boomers, Bubble Guns)	Collection of geophysical data for shallow hazards and archaeological resources assessments and to characterize subsurface sediments	High-resolution CHIRP System sub-bottom profiler or boomers are used to generate a profile view below the bottom of the seabed, which is interpreted to develop a geologic cross-section of subsurface sediment conditions under the track line surveyed. Another type of sub-bottom profiler that may be employed is a medium penetration system such as a boomer, bubble pulser or impulse-type system. Sub-bottom profilers are capable of penetrating sediment depth ranges of 10 ft. (3 m) to greater than 328 ft. (100 m), depending on frequency and bottom composition.
Side-Scan Sonar	Collection of geophysical data for shallow hazards and archaeological resources assessments	This survey evaluates surface and near-surface sediments, seafloor morphology, and potential surface obstructions (MMS, 2007a). A typical side-scan sonar system consists of a top-side processor, tow cable, and towfish with transducers (or "pingers") located on the sides. Typically, a lessee would use a digital dual-frequency side-scan sonar system with 300 to 500 kHz frequency ranges or greater to record continuous planimetric images of the seafloor.

Table A.2. Acoustic Characteristics of Representative HRG Survey Equipment. Note list of equipment is representative and surveys may use similar equipment and actual source levels may be below those indicated.

	Highest Measured Source Level (Highest Power Setting)						
HRG Source	**Source Setting**	**PK**	**RMS**	**SEL**	**Pulse Width (s)**	**Main Pulse Frequency (kHz)**	**Inter-Pulse Interval (s) (1/PPS)**
Mobile, Impulsive, Intermittent Sources							
AA200 Boomer Plate	250 J (low)	209	200	169	0.0008	4.3	1.0 (1 pps)
AA251 Boomer Plate	300 J (high)	216	207	176	0.0007	4.3	1.0 (1 pps)
Applied Acoustic Delta Sparker	2400 J at 1 m depth, 0.5 kHz	221	205	185	0.0095	0.5	.33333 (1-3 pps)
Applied Acoustic Dura-Spark	2400 J (high), 400 tips	225	214	188	0.0022	2.7	.33333 (1-3 pps)
Applied Acoustics S-Boom (3 AA252 boomer plates)	700 J	211	205	172	0.0006	6.2	1.0 (1 pps)
Applied Acoustics S-Boom (CSP-N Source)	1000 J	209	203	172	0.0009	3.8	.33333 (3 pps)
ELC820 Sparker	750 J (high) 1m depth	214	206	182	0.0039	1.2	1.0 (1 pps)
FSI HMS-620D Bubble Gun	Dual Channel 86 cm	204	198	173	0.0033	1.1	8.0 (1 per 8 s)
Mobile, Non-Impulsive, Intermittent Sources							
Bathyswath SWATHplus-M	100%, 234 kHz	223	218	180	0.00032	≥200 kHz	0.2000 pps (unknown)
Echotrac CV100 Single-Beam Echosounder	Power 12, 80 cycles, 200 kHz	196	193	159	0.00036	≥200 kHz	0.0500 (20 pps)
EdgeTech 424 with 3200-XS topside processor (Chirp)	100% power, 4-20 kHz	187	180	156	0.0046	7.2-11	.12500 (8 pps)

EdgeTech 512i Sub-bottom Profiler, 8.9 kHz (Chirp)	100% power, 2-12 kHz	186	180	159	0.0087	6.3-8.9	.12500 (8 pps)
EdgeTech 4200 Side-Scan	100%, 100 kHz (also a 400 kHz setting)	206	201	179	0.0072	100 kHz	.03333 (30 pps)
Klein 3000 Side-Scan	132 kHz (also capable of 445 kHz)	224	219	184	0.000343	132 kHz	.03333 (30 pps)
Klein 3900 Side-Scan	445 kHz	226	220	179	0.000084	≥200 kHz	unreported
Knudsen 3202 Sub-bottom Profiler (2 transducers), 5.7 kHz	Power 4	214	209	193	0.0217	3.3-5.7	0.25000 (4 pps)
Reson Seabat 7111 Multibeam Echosounder	100 kHz	228	224	185	0.00015	100 kHz	0.0500 (20 pps)
Reson Seabat T20P Multibeam Echosounder	200, 300, or 400 kHz	221	218	182	0.00025	≥200 kHz	0.0200 (50 pps)

Source: Highest reported source levels reported in Crocker and Fratantonio (2016).

Table 1. Predicted isopleths for peak pressure (using 20 LogR) and cSEL using NOAA's general spreadsheet tool (December 2020 Revision) to predict cumulative exposure distances using the highest power levels were used for each sound source reported in Crocker and Fratantonio (2016).

HRG SOURCE	PTS INJURY DISTANCE (m)							
	Low Frequency Cetaceans		Mid Frequency Cetaceans		High Frequency Cetaceans		Seals (Phocids)	
	PK	SEL	PK	SEL	PK	SEL	PK	SEL
AA200 Boomer Plate	0	0.1	0	0	2.2	0.9	0	0.0
AA251 Boomer Plate	0	0.3	0	0	5.0	4.7	0.0	0.2
Applied Acoustics S-Boom (3 AA252 boomer plates)	0	0.1	0	0.0	2.8	5.6	0	0.1
Applied Acoustics S-Boom (CSP-N Source)	0	0.3	0	0	2.2	3.7	0	0.2
FSI HMS-620D Bubble Gun (impulsive)	0	0	0	0	1.3	0	0	0
ELC820 Sparker (impulsive)	0	3.2	0	0	4.0	0.7	0.0	0.7

HRG SOURCE	PTS INJURY DISTANCE (m)							
	Low Frequency Cetaceans		Mid Frequency Cetaceans		High Frequency Cetaceans		Seals (Phocids)	
	PK	SEL	PK	SEL	PK	SEL	PK	SEL
Applied Acoustics Dura-Spark (impulsive)	2.0	12.7	0	0.2	14.1	47.3	2.2	6.4
Applied Acoustics Delta Sparker (impulsive)	1.3	5.7	0	0	8.9	0.1	1.4	0.3
EdgeTech 424 Sub-bottom profiler 3200-XS, 7.2 kHz	—	0	—	0	—	0.0	—	0
EdgeTech 512i Sub-bottom Profiler, 6.39 kHz	—	0	—	0	—	0.0	—	0
Knudsen 3202 Chirp Sub-bottom profiler (2 transducers), 5.7 kHz	—	1.2	—	0.3	—	35.2	—	<1
Reson Seabat 7111 Multibeam Echosounder,100 kHz	—	0	—	0.5	—	251.4	—	0.0
Reson Seabat T20P Multibeam Echosounder	—	0	—	0	—	0	—	0
Bathyswath SWATHplus-M	—	0	—	0	—	0	—	0
Echotrac CV100 Single-Beam Echosounder	—	0	—	0	—	0	—	0
Klein 3000 Side-Scan, 132 kHz	—	0	—	0.4	—	193.6	—	0.0
Klein 3000 Side-Scan, 445 kHz	—	0	—	0	—	0	—	0
Klein 3900 Side-Scan, 445 kHz	—	0	—	0	—	0	—	0

Table A.4. PTS distance for sea turtles and listed fish for impulsive HRG sound sources (60 minutes duration using the highest power levels were used for each sound source reported in Crocker and Fratantonio (2016)).

HRG SOURCE		Sea Turtles*, ESA-listed Fish			
		PTS INJURY DISTANCE (m) for Impulsive HRG Sources			
	SEL Source level	Fish cSEL[a] Distance to 187 dB (m)	Turtle cSEL[a] Distance (m)	Peak Source Level	Fish Peak Distance to 206 dB (m)
AA200 Boomer Plate	169	0	0	209	1.4
AA251 Boomer Plate	176	0	0	216	3.2
Applied Acoustics S-Boom (3 AA252 boomer plates)	172	0	0	211	2.5
Applied Acoustics S-Boom (CSP-N Source)	172	0	0	209	1.4
FSI HMS-620D Bubble Gun (impulsive)	173	0	0	204	0
ELC820 Sparker (impulsive)	182	0	0	214	4.0

HRG SOURCE		Sea Turtles*, ESA-listed Fish			
		PTS INJURY DISTANCE (m) for Impulsive HRG Sources			
	SEL Source level	Fish cSEL[a] Distance to 187 dB (m)	Turtle cSEL[a] Distance (m)	Peak Source Level	Fish Peak Distance to 206 dB (m)
Applied Acoustics Dura-Spark (impulsive)	188	1.6	0	225	9.0
Applied Acoustics Delta Sparker (impulsive)	185	1.1	0	221	5.7
EdgeTech 424 Sub-bottom profiler 3200-XS, 7.2 kHz	156	NA	NA	187	NA
EdgeTech 512i Sub-bottom Profiler, 8.9 kHz	159	NA	NA	186	NA
Knudsen 3202 Chirp Sub-bottom profiler (2 transducers), 5.7 kHz	193	NA	NA	214	NA
Reson Seabat 7111 Multibeam Echosounder,100 kHz	185	NA	NA	228	NA
Reson Seabat T20P Multibeam Echosounder	182	NA	NA	221	NA
Bathyswath SWATHplus-M	180	NA	NA	223	NA
Echotrac CV100 Single-Beam Echosounder	159	NA	NA	196	NA
Klein 3000 Side-Scan, 132 kHz	184	NA	NA	224	NA
Klein 3000 Side-Scan, 445 kHz	179	NA	NA	226	NA
EdgeTech 4200 Side-Scan, 100 kHz	169	NA	NA	206	NA
EdgeTech 4200 Side-Scan, 400 kHz	176	NA	NA	210	NA

[a] = cSEL distances were calculated by 20 log(Source Level + 10 log(1800 sec) – Threshold Level)
NA = Frequencies are out of the hearing range of the sea turtles, sturgeon, and salmon
*Sea Turtle peak pressure distances for all HRG sources are below the threshold level of 232dB.

Table A.5. Disturbances distances for marine mammals (160 dB RMS), sea turtles (175 dB RMS), and fish (150 dB RMS) using 20LogR spherical spreading loss using the highest power levels were used for each sound source reported in Crocker and Fratantonio (2016).

HRG SOURCE	DISTANCE OF POTENTIAL DISTURBANCE (m)*		
	Marine Mammals	Sea Turtles	Fish
AA200 Boomer Plate	100	18	317
AA251 Boomer Plate	224	40	708
Applied Acoustics S-Boom (3 AA252 boomer plates)	178	32	563
Applied Acoustics S-Boom (CSP-N Source)	142	26	447

FSI HMS-620D Bubble Gun	80	15	252
ELC820 Sparker	200	36	631
Applied Acoustics Dura-Spark	502	90	1,996
Applied Acoustics Delta Sparker	178	32	563
EdgeTech 424 Sub-bottom Profiler, 7.2 and 11 kHz	10	2	32
EdgeTech 512i Sub-bottom Profiler	10	2	32
Knudsen 3202 Echosounder (2 transducers)	892	NA	NA
Reson Seabat 7111 Multibeam Echosounder[1]	NA	NA	NA
Reson Seabat T20P Multibeam Echosounder[1]	NA	NA	NA
Bathyswath SWATHplus-M	NA	NA	NA
Echotrac CV100 Single-Beam Echosounder[1]	NA	NA	NA
Klein 3000 Side-Scan, 132 kHz	NA	NA	NA
Klein 3000 Side-Scan, 445 kHz	NA	NA	NA
Klein 3900 Side-scan, 445 kHz	NA	NA	NA
EdgeTech 4200 Side-Scan, 100 kHz	NA	NA	NA
EdgeTech 4200 Side-Scan, 400 kHz	NA	NA	NA

NA = Not Audible
[1] These multi-beam echosounder and side-scan sonars are only audible to mid- and high-frequency hearing groups of marine mammals.
* Disturbance distances have been round up to the next nearest whole number.

APPENDIX B

Project Design Criteria (PDC) and Best Management Practices (BMPs) for Threatened and Endangered Species for Site Characterization and Site Assessment Activities to Support Offshore Wind Projects

Any survey plan must meet the following minimum requirements specified below, except when complying with these requirements would put the safety of the vessel or crew at risk.

PDC 1: Avoid Live Bottom Features

BMPs:

1. All vessel anchoring and any seafloor-sampling activities (i.e., drilling or boring for geotechnical surveys) are restricted from seafloor areas with consolidated seabed features.[1] All vessel anchoring and seafloor sampling must also occur at least 150 m from any known locations of threatened or endangered coral species. All sensitive live bottom habitats (eelgrass, cold-water corals, etc.) should be avoided as practicable. All vessels in coastal waters will operate in a manner to minimize propeller wash and seafloor disturbance and transiting vessels should follow deep-water routes (e.g., marked channels), as practicable, to reduce disturbance to sturgeon and sawfish habitat.

PDC 2: Avoid Activities that Could Affect Early Life Stages of Atlantic Sturgeon

BMP:

1. No geotechnical or bottom disturbing activities will take place during the spawning/rearing season within freshwater reaches of rivers where Atlantic or shortnose sturgeon spawning occurs. Any survey plan that includes geotechnical or other benthic sampling activities in freshwater reaches (salinity 0-0.5 ppt) of such rivers will identify a time of year restriction that will avoid such activities during the time of year when Atlantic sturgeon spawning and rearing of early life stages occurs in that river. Appropriate time of year restrictions include the following:

River	No Work Window	Area Affected
Hudson	April – July	Upstream of the Delaware Memorial Bridge
Delaware	April – July	Upstream of Newburgh, NY - Beacon Bridge/Rt 84

This table will be supplemented with additional rivers as necessary.

PDC 3: Marine Trash and Debris Awareness and Prevention

"*Marine trash and debris*" is defined as any object or fragment of wood, metal, glass, rubber, plastic, cloth, paper or any other solid, man-made item or material that is lost or discarded in the marine environment by the Lessee or an authorized representative of the Lessee (collectively, the

[1] Consolidated seabed features for this measure are pavement, scarp walls, and deep/cold-water coral reefs and shallow/mesophotic reefs as defined in the CMECS Geologic Substrate Classifications.

"Lessee") while conducting activities on the OCS in connection with a lease, grant, or approval issued by the Department of the Interior (DOI). To understand the type and amount of marine debris generated, and to minimize the risk of entanglement in and/or ingestion of marine debris by protected species, lessees must implement the following BMPS.

BMPs:

1. Training: All vessel operators, employees, and contractors performing OCS survey activities on behalf of the Lessee (collectively, "Lessee Representatives") must complete marine trash and debris awareness training annually. The training consists of two parts: (1) viewing a marine trash and debris training video or slide show (described below); and (2) receiving an explanation from management personnel that emphasizes their commitment to the requirements. The marine trash and debris training videos, training slide packs, and other marine debris related educational material may be obtained at https://www.bsee.gov/debris. The training videos, slides, and related material may be downloaded directly from the website. Lessee Representatives engaged in OCS survey activities must continue to develop and use a marine trash and debris awareness training and certification process that reasonably assures that they, as well as their respective employees, contractors, and subcontractors, are in fact trained. The training process must include the following elements:
    a. Viewing of either a video or slide show by the personnel specified above;
    b. An explanation from management personnel that emphasizes their commitment to the requirements;
    c. Attendance measures (initial and annual); and
    d. Recordkeeping and availability of records for inspection by DOI.

   By January 31 of each year, the Lessee must submit to DOI an annual report signed by the Lessee that describes its marine trash and debris awareness training process and certifies that the training process has been followed for the previous calendar year. You must send the reports via email to *renewable_reporting@boem.gov* and to *marinedebris@bsee.gov*.

2. Marking: Materials, equipment, tools, containers, and other items used in OCS activities which are of such shape or configuration that they are likely to snag or damage fishing devices, and could be lost or discarded overboard, must be clearly marked with the vessel or facility identification and properly secured to prevent loss overboard. All markings must clearly identify the owner and must be durable enough to resist the effects of the environmental conditions to which they may be exposed.

3. Recovery: Lessees must recover marine trash and debris that is lost or discarded in the marine environment while performing OCS activities when such incident is likely to: (a) cause undue harm or damage to natural resources, including their physical, atmospheric, and biological components, with particular attention to those that could result in the entanglement of or ingestion by marine protected species; or (b) significantly interfere with OCS uses (e.g., are likely to snag or damage fishing

equipment, or present a hazard to navigation). Lessees must notify DOI when recovery activities are (i) not possible because conditions are unsafe; or (ii) not practicable because the marine trash and debris released is not likely to result in any of the conditions listed in (a) or (b) above. The lessee must recover the marine trash and debris lost or discarded if DOI does not agree with the reasons provided by the Lessee to be relieved from the obligation to recover the marine trash and debris. If the marine trash and debris is located within the boundaries of a potential archaeological resource/avoidance area, or a sensitive ecological/benthic resource area, the Lessee must contact DOI for approval prior to conducting any recovery efforts.

Recovery of the marine trash and debris should be completed immediately, but no later than 30 days from the date in which the incident occurred. If the Lessee is not able to recover the marine trash or debris within 48 hours (*See* BMP 4. Reporting), the Lessee must submit a recovery plan to DOI explaining the recovery activities to recover the marine trash or debris ("Recovery Plan"). The Recovery Plan must be submitted no later than 10 calendar days from the date in which the incident occurred. Unless otherwise objected by DOI within 48 hours of the filing of the Recovery Plan, the Lessee can proceed with the activities described in the Recovery Plan. The Lessee must request and obtain approval of a time extension if recovery activities cannot be completed within 30 days from the date in which the incident occurred. The Lessee must enact steps to prevent similar incidents and must submit a description of these actions to BOEM and BSEE within 30 days from the date in which the incident occurred.

4. Reporting: The Lessee must report all marine trash and debris lost or discarded to DOI (using the email address listed on DOI's most recent incident reporting guidance). This report applies to all marine trash and debris lost or discarded, and must be made monthly, no later than the fifth day of the following month. The report must include the following:

    a. Project identification and contact information for the lessee, operator, and/or contractor;
    b. The date and time of the incident;
    c. The lease number, OCS area and block, and coordinates of the object's location (latitude and longitude in decimal degrees);
    d. A detailed description of the dropped object to include dimensions (approximate length, width, height, and weight) and composition (e.g., plastic, aluminum, steel, wood, paper, hazardous substances, or defined pollutants);
    e. Pictures, data imagery, data streams, and/or a schematic/illustration of the object, if available;
    f. Indication of whether the lost or discarded item could be a magnetic anomaly of greater than 50 nanoTesla (nT), a seafloor target of greater than 0.5 meters (m), or a sub-bottom anomaly of greater than 0.5m when operating a magnetometer or gradiometer, side scan sonar, or sub-bottom profile in accordance with DOI's applicable guidance;
    g. An explanation of how the object was lost; and

h. A description of immediate recovery efforts and results, including photos.

In addition to the foregoing, the Lessee must submit a report within 48 hours of the incident ("48-hour Report") if the marine trash or debris could (a) cause undue harm or damage to natural resources, including their physical, atmospheric, and biological components, with particular attention to those that could result in the ingestion by or entanglement of marine protected species; or (b) significantly interfere with OCS uses (e.g., are likely to snag or damage fishing equipment, or present a hazard to navigation). The information in the 48-hour Report would be the same as that listed above, but just for the incident that triggered the 48-hour Report. The Lessee must report to DOI if the object is recovered and, as applicable, any substantial variation in the activities described in the Recovery Plan that were required during the recovery efforts. Information on unrecovered marine trash and debris must be included and addressed in the description of the site clearance activities provided in the decommissioning application required under 30 CFR § 585.906. The Lessee is not required to submit a report for those months in which no marine trash and debris was lost or discarded.

PDC 4: Minimize Interactions with Listed Species during Geophysical Survey Operations
To avoid injury of ESA-listed species and minimize any potential disturbance, the following measures will be implemented for all vessels operating impulsive survey equipment that emits sound at frequency ranges <180 kHz (within the functional hearing range of marine mammals)[2] as well as CHIRP sub bottom profilers. The Clearance Zone is defined as the area around the sound source that needs to be visually cleared of listed species for 30 minutes before the sound source is turned on. The Clearance Zone is equivalent to a minimum visibility zone for survey operations to begin (*See* BMP 6). The Shutdown Zone is defined as the area around the sound source that must be monitored for possible shutdown upon detection of protected species within or entering that zone. For both the Clearance and Shutdown Zones, these are minimum visibility distances and for situational awareness PSOs should observe beyond this area when possible.

BMPs:

1. For situational awareness a Clearance Zone extending at least (500 m in all directions) must be established around all vessels operating sources <180 kHz.
    a. The Clearance Zone must be monitored by approved third-party PSOs at all times and any observed listed species must be recorded (see reporting requirements below).
    b. For monitoring around the autonomous surface vessel (ASV) where remote PSO monitoring must occur from the mother vessel, a dual thermal/HD camera must be installed on the mother vessel facing forward and angled in a direction so as to provide a field of view ahead of the vessel and around the ASV. PSOs must be able to monitor the real-time output of the camera on hand-held computer tablets. Images from the cameras must be able to be captured and reviewed to assist in verifying species identification. A monitor must also be installed in the bridge displaying the real-time images from the thermal/HD camera installed on

[2] Note that this requirement does not apply to Parametric Subbottom Profilers, Ultra Short Baseline, echosounders or side scan sonar; the acoustic characteristics (frequency, narrow beam width, rapid attenuation) are such that no effects to listed species are anticipated.

the front of the ASV itself, providing a further forward view of the craft. In addition, night-vision goggles with thermal clip-ons and a handheld spotlight must be provided and used such that PSOs can focus observations in any direction around the mother vessel and/or the ASV.

2. To minimize exposure to noise that could be disturbing, Shutdown Zone(s) (500 m for North Atlantic right whales and 100 m for other ESA-listed whales visible at the surface) must be established around the sources operating at <180 kHz being towed from the vessel .
    a. The Shutdown Zone(s) must be monitored by third-party PSOs at all times when noise-producing equipment (<180 kHz) is being operated and all observed listed species must be recorded (see reporting requirements below).
    b. If an ESA-listed species is detected within or entering the respective Shutdown Zone, any noise-producing equipment operating below 180 kHz must be shut off until the minimum separation distance from the source is re-established (500 m for North Atlantic right whales and 100 m for other ESA-listed species, including other ESA-listed marine mammals) and the measures in (5) are carried out.
        i. A PSO must notify the survey crew that a shutdown of all active boomer, sparker, and bubble gun acoustic sources below 180 kHz is immediately required. The vessel operator and crew must comply immediately with any call for a shutdown by the PSO. Any disagreement or discussion must occur only after shutdown.
    c. If the Shutdown Zone(s) cannot be adequately monitored for ESA-listed species presence (i.e., a PSO determines conditions, including at night or other low-visibility conditions, are such that listed species cannot be reliably sighted within the Shutdown Zone(s), no equipment operating at <180 kHz can be deployed until such time that the Shutdown Zone(s) can be reliably monitored.
3. Before any noise-producing survey equipment (operating at <180 kHz) is deployed, the Clearance Zone (500 m for all listed species) must be monitored for 30 minutes of pre-clearance observation.
    a. If any ESA-listed species is observed within the Clearance Zone during the 30-minute pre-clearance period, the 30-minute clock must be paused. If the PSO confirms the animal has exited the zone and headed away from the survey vessel, the 30-minute clock that was paused may resume. The pre-clearance clock will reset to 30 minutes if the animal dives or visual contact is otherwise lost.
4. When technically feasible, a “ramp up” of the electromechanical survey equipment must occur at the start or re-start of geophysical survey activities. A ramp up must begin with the power of the smallest acoustic equipment for the geophysical survey at its lowest power output. When technically feasible the power will then be gradually turned up and other acoustic sources added in a way such that the source level would increase gradually.
5. Following a shutdown for any reason, ramp up of the equipment may begin immediately only if: (a) the shutdown is less than 30 minutes, (b) visual monitoring of

the Shutdown Zone(s) continued throughout the shutdown, (c) the animal(s) causing the shutdown was visually followed and confirmed by PSOs to be outside of the Shutdown Zone(s) (500 m for North Atlantic right whales and 100 m for other ESA-listed species, including other ESA-listed marine mammals) and heading away from the vessel, and (d) the Shutdown Zone(s) remains clear of all listed species. If all (a, b, c, and d) the conditions are not met, the Clearance Zone (500 m for all listed species) must be monitored for 30 minutes of pre-clearance observation before noise-producing equipment can be turned back on.

6. In order for geophysical surveys to be conducted at night or during low-visibility conditions, PSOs must be able to effectively monitor the Clearance and Shutdown Zone(s). No may occur if the Clearance and Shutdown Zone(s) cannot be reliably monitored for the presence of ESA-listed species to ensure avoidance of injury to those species.
    a. An Alternative Monitoring Plan (AMP) must be submitted to BOEM (or the federal agency authorizing, funding, or permitting the survey) detailing the monitoring methodology that will be used during nighttime and low-visibility conditions and an explanation of how it will be effective at ensuring that the Shutdown Zone(s) can be maintained during nighttime and low-visibility survey operations. The plan must be submitted 60 days before survey operations are set to begin.
    b. The plan must include technologies that have the technical feasibility to detect all ESA-listed whales out to 500 m and sea turtles to 100 m.
    c. PSOs should be trained and experienced with the proposed alternative monitoring technology.
    d. The AMP must describe how calibration will be performed, for example, by including observations of known objects at set distances and under various lighting conditions. This calibration should be performed during mobilization and periodically throughout the survey operation.
    e. PSOs shall make nighttime observations from a platform with no visual barriers, due to the potential for the reflectivity from bridge windows or other structures to interfere with the use of the night vision optics.
7. To minimize risk to North Atlantic right whales, no surveys may occur in Cape Cod Bay from January 1 - May 15 of any year (in an area beginning at 42°04′56.5″ N-070°12′00.0″ W; thence north to 42°12′00.0″ N-070°12′00.0″ W; thence due west to charted mean high water line; thence along charted mean high water within Cape Cod Bay back to beginning point).
8. Sound sources used within the North Atlantic right whale Critical Habitat Southeastern U.S. Calving Area (i.e., Unit 2) during the calving and nursing season (December-March) shall operate at frequencies <7 kHz and >35 kHz (functional hearing range of right whales) at night or low visibility conditions.
9. At times when multiple survey vessels are operating within a lease area, adjacent lease areas, or exploratory cable routes, a minimum separation distance (to be determined on a survey specific basis, dependent on equipment being used) must be maintained between survey vessels to ensure that sound sources do not overlap.
10. To minimize disturbance to the Northwest Atlantic Ocean DPS of loggerhead sea turtles, a voluntary pause in sparker operation should be implemented for all vessels

operating in nearshore critical habitat for loggerhead sea turtles. These conditions apply to critical habitat boundaries for nearshore reproductive habitats LOGG N-3 through LOGG N-16 (79 FR 39855) from April 1 to September 30. Following pre-clearance procedures, if any loggerhead or other unidentified sea turtles is observed within a 100 m Clearance Zone during a survey, sparker operation should be paused by turning off the sparker until the sea turtle is beyond 100 m of the survey vessel. If the animal dives or visual contact is otherwise lost, sparker operation may resume after a minimum 2-minute pause following the last sighting of the animal.

11. Any visual observations of listed species by crew or project personnel must be communicated to PSOs on-duty.
12. During good conditions (e.g., daylight hours; Beaufort scale 3 or less) when survey equipment is not operating, to the maximum extent practicable, PSOs must conduct observations for protected species for comparison of sighting rates and behavior with and without use of active geophysical survey equipment. Any observed listed species must be recorded regardless of any mitigation actions required.

PDC 5: Minimize Vessel Interactions with Listed Species
All vessels associated with survey activities (transiting [i.e., travelling between a port and the survey site] or actively surveying) must comply with the vessel strike avoidance measures specified below. The only exception is when the safety of the vessel or crew necessitates deviation from these requirements. If any such incidents occur, they must be reported as outlined below under Reporting Requirements (PDC 8). The Vessel Strike Avoidance Zone is defined as 500 m or greater from any sighted ESA-listed species or other unidentified large marine mammal.

BMPs:

1. Vessel captain and crew must maintain a vigilant watch for all protected species and slow down, stop their vessel, or alter course, as appropriate and regardless of vessel size, to avoid striking any listed species. The presence of a single individual at the surface may indicate the presence of submerged animals in the vicinity; therefore, precautionary measures should always be exercised. If pinnipeds or small delphinids of the following genera: Delphinus, Lagenorhynchus, Stenella, and Tursiops are visually detected approaching the vessel (i.e., to bow ride) or towed equipment, vessel strike avoidance and shutdown is not required.
2. Anytime a survey vessel is underway (transiting or surveying), the vessel must maintain a 500 m minimum separation distance and a PSO must monitor a Vessel Strike Avoidance Zone (500 m or greater from any sighted ESA-listed species or other unidentified large marine mammal visible at the surface) to ensure detection of that animal in time to take necessary measures to avoid striking the animal. If the survey vessel does not require a PSO for the type of survey equipment used, a trained crew lookout may be used (see #3). For monitoring around the autonomous surface vessels, regardless of the equipment it may be operating, a dual thermal/HD camera must be installed on the mother vessel facing forward and angled in a direction so as to provide a field of view ahead of the vessel and around the ASV. A dedicated operator must be able to monitor the real-time output of the camera on hand-held computer tablets. Images from the cameras must be able to be captured and reviewed to assist in verifying species identification. A monitor must also be

installed in the bridge displaying the real-time images from the thermal/HD camera installed on the front of the ASV itself, providing a further forward view of the craft.

a. Survey plans must include identification of vessel strike avoidance measures, including procedures for equipment shut down and retrieval, communication between PSOs/crew lookouts, equipment operators, and the captain, and other measures necessary to avoid vessel strike while maintaining vessel and crew safety. If any circumstances are anticipated that may preclude the implementation of this PDC, they must be clearly identified in the survey plan and alternative procedures outlined in the plan to ensure minimum distances are maintained and vessel strikes can be avoided.
b. All vessel crew members must be briefed in the identification of protected species that may occur in the survey area and in regulations and best practices for avoiding vessel collisions. Reference materials must be available aboard all project vessels for identification of listed species. The expectation and process for reporting of protected species sighted during surveys must be clearly communicated and posted in highly visible locations aboard all project vessels, so that there is an expectation for reporting to the designated vessel contact (such as the lookout or the vessel captain), as well as a communication channel and process for crew members to do so.
c. The Vessel Strike Avoidance Zone(s) are a minimum and must be maintained around all surface vessels at all times.
d. If a large whale is identified within 500 m of the forward path of any vessel, the vessel operator must steer a course away from the whale at 10 knots (18.5 km/hr) or less until the 500 m minimum separation distance has been established. Vessels may also shift to idle if feasible.
e. If a large whale is sighted within 200 m of the forward path of a vessel, the vessel operator must reduce speed and shift the engine to neutral. Engines must not be engaged until the whale has moved outside of the vessel's path and beyond 500 m. If stationary, the vessel must not engage engines until the large whale has moved beyond 500 m.
f. If a sea turtle or manta ray is sighted within the operating vessel's forward path, the vessel operator must slow down to 4 knots (unless unsafe to do so) and steer away as possible. The vessel may resume normal operations once the vessel has passed the individual.
g. During times of year when sea turtles are known to occur in the survey area, vessels must avoid transiting through areas of visible jellyfish aggregations or floating vegetation (e.g., sargassum lines or mats). In the event that operational safety prevents avoidance of such areas, vessels must slow to 4 knots while transiting through such areas.
h. Vessels operating in water depths with less than 4 ft. clearance between the vessel and the bottom should maintain speeds no greater than 4 knots to minimize vessel strike risk to sturgeon and sawfish.

3. To monitor the Vessel Strike Avoidance Zone, a PSO (or crew lookout if PSOs are not required) must be posted during all times a vessel is underway (transiting or surveying) to monitor for listed species in all directions.

   a. Visual observers monitoring the vessel strike avoidance zone can be either PSOs or crew members (if PSOs are not required). If the trained lookout is a vessel crew member, this must be their designated role and primary responsibility while the vessel is transiting. Any designated crew lookouts must receive training on protected species identification, vessel strike minimization procedures, how and when to communicate with the vessel captain, and reporting requirements. All observations must be recorded per reporting requirements.
   b. Regardless of monitoring duties, all crew members responsible for navigation duties must receive site-specific training on ESA-listed species sighting/reporting and vessel strike avoidance measures.
4. Regardless of vessel size, vessel operators must reduce vessel speed to 10 knots (18.5 mph) or less while operating in any Seasonal Management Area (SMA), Dynamic Management Area (DMA)/Slow Zones triggered by visual detection of North Atlantic right whales. The only exception to this requirement is for vessels operating in areas within a DMA/visually triggered Slow Zone where it is not reasonable to expect the presence of North Atlantic right whales (e.g. Long Island Sound, shallow harbors). Reducing vessel speed to 10 knots or less while operating in Slow Zones triggered by acoustic detections of North Atlantic right whales is encouraged.
5. Vessels underway must not divert their course to approach any listed species.
6. All vessel operators must check for information regarding mandatory or voluntary ship strike avoidance (SMAs, DMAs, Slow Zones) and daily information regarding North Atlantic right whale sighting locations. These media may include, but are not limited to: NOAA weather radio, U.S. Coast Guard NAVTEX and channel 16 broadcasts, Notices to Mariners, the Whale Alert app, or WhaleMap website.
   a. North Atlantic right whale Sighting Advisory System info can be accessed at: https://apps-nefsc.fisheries.noaa.gov/psb/surveys/MapperiframeWithText.html
   b. Information about active SMAs, DMAs, and Slow Zones can be accessed at: https://www.fisheries.noaa.gov/national/endangered-species-conservation/reducing-vessel-strikes-north-atlantic-right-whales

PDC 6: Minimize Risk During Buoy Deployment, Operations, and Retrieval
Any mooring systems used during survey activities prevent any potential entanglement or entrainment of listed species, and in the unlikely event that entanglement does occur, ensure proper reporting of entanglement events according to the measures specified below.

BMPs:

1. Ensure that any buoys attached to the seafloor use the best available mooring systems. Buoys, lines (chains, cables, or coated rope systems), swivels, shackles, and anchor designs must prevent any potential entanglement of listed species while ensuring the safety and integrity of the structure or device.
2. All mooring lines and ancillary attachment lines must use one or more of the following measures to reduce entanglement risk: shortest practicable line length, rubber sleeves, weak-links, chains, cables or similar equipment types that prevent lines from looping, wrapping, or entrapping protected species.
3. Any equipment must be attached by a line within a rubber sleeve for rigidity. The length of the line must be as short as necessary to meet its intended purpose.

4. During all buoy deployment and retrieval operations, buoys should be lowered and raised slowly to minimize risk to listed species and benthic habitat. Additionally, PSOs or trained project personnel (if PSOs are not required) should monitor for listed species in the area prior to and during deployment and retrieval and work should be stopped if listed species are observed within 500 m of the vessel to minimize entanglement risk.
5. If a live or dead marine protected species becomes entangled, you must immediately contact the applicable NMFS stranding coordinator using the reporting contact details (see Reporting Requirements section) and provide any on-water assistance requested.
6. All buoys must be properly labeled with owner and contact information.

PDC 7: Protected Species Observers
Qualified third-party PSOs to observe Clearance and Shutdown Zones must be used as outlined in the conditions above.

BMPs:

1. All PSOs must have completed an approved PSO training program and must receive NMFS approval to act as a PSO for geophysical surveys. Documentation of NMFS approval for geophysical survey activities in the Atlantic and copies of the most recent training certificates of individual PSOs' successful completion of a commercial PSO training course with an overall examination score of 80% or greater must be provided upon request. Instructions and application requirements to become a NMFS-approved PSO can be found at: *www.fisheries.noaa.gov/national/endangered-species-conservation/protected-species-observers*.
2. In situations where third-party party PSOs are not required, crew members serving as lookouts must receive training on protected species identification, vessel strike minimization procedures, how and when to communicate with the vessel captain, and reporting requirements.
3. PSOs deployed for geophysical survey activities must be employed by a third-party observer provider. While the vessel is underway, they must have no other tasks than to conduct observational effort, record data, and communicate with and instruct relevant vessel crew to the presence of listed species and associated mitigation requirements. PSOs on duty must be clearly listed on daily data logs for each shift.
   a. Non-third-party observers may be approved by NMFS on a case-by-case basis for limited, specific duties in support of approved, third-party PSOs.
4. A minimum of one PSO (assuming condition 5 is met) must be on duty observing for listed species at all times that noise-producing equipment <180 kHz is operating, or the survey vessel is actively transiting during daylight hours (i.e. from 30 minutes prior to sunrise and through 30 minutes following sunset). Two PSOs must be on duty during nighttime operations. A PSO schedule showing that the number of PSOs used is sufficient to effectively monitor the affected area for the project (e.g., surveys) and record the required data must be included. PSOs must not be on watch for more than 4 consecutive hours, with at least a 2-hour break after a 4-hour watch. PSOs must not be on active duty observing for more than 12 hours in any 24-hour period.
5. Visual monitoring must occur from the most appropriate vantage point on the associated operational platform that allows for 360-degree visual coverage around the vessel. If

360-degree visual coverage is not possible from a single vantage point, multiple PSOs must be on watch to ensure such coverage.

6. Suitable equipment must be available to each PSO to adequately observe the full extent of the Clearance and Shutdown Zones during all vessel operations and meet all reporting requirements.
    a. Visual observations must be conducted using binoculars and the naked eye while free from distractions and in a consistent, systematic, and diligent manner.
    b. Rangefinders (at least one per PSO, plus backups) or reticle binoculars (e.g., 7 x 50) of appropriate quality (at least one per PSO, plus backups) to estimate distances to listed species located in proximity to the vessel and Clearance and Shutdown Zone(s).
    c. Digital full frame cameras with a telephoto lens that is at least 300 mm or equivalent. The camera or lens should also have an image stabilization system. Used to record sightings and verify species identification whenever possible.
    d. A laptop or tablet to collect and record data electronically.
    e. Global Positioning Units (GPS) if data collection/reporting software does not have built-in positioning functionality.
    f. PSO data must be collected in accordance with standard data reporting, software tools, and electronic data submission standards approved by BOEM and NMFS for the particular activity.
    g. Any other tools deemed necessary to adequately perform PSO tasks.

PDCs 8: Reporting Requirements
To ensure compliance and evaluate effectiveness of mitigation measures, regular reporting of survey activities and information on listed species will be required as follows.

BMPs:

1. Data from all PSO observations must be recorded based on standard PSO collection and reporting requirements. PSOs must use standardized electronic data forms to record data. The following information must be reported electronically in a format approved by BOEM and NMFS:
    Visual Effort:
    a. Vessel name;
    b. Dates of departures and returns to port with port name;
    c. Lease number;
    d. PSO names and affiliations;
    e. PSO ID (if applicable);
    f. PSO location on vessel;
    g. Height of observation deck above water surface (in meters);
    h. Visual monitoring equipment used;
    i. Dates and times (Greenwich Mean Time) of survey on/off effort and times corresponding with PSO on/off effort;
    j. Vessel location (latitude/longitude, decimal degrees) when survey effort begins and ends; vessel location at beginning and end of visual PSO duty shifts; recorded at 30 second intervals if obtainable from data collection software, otherwise at practical regular interval;

k. Vessel heading and speed at beginning and end of visual PSO duty shifts and upon any change;
l. Water depth (if obtainable from data collection software) (in meters);
m. Environmental conditions while on visual survey (at beginning and end of PSO shift and whenever conditions change significantly), including wind speed and direction, Beaufort scale, Beaufort wind force, swell height (in meters), swell angle, precipitation, cloud cover, sun glare, and overall visibility to the horizon;
n. Factors that may be contributing to impaired observations during each PSO shift change or as needed as environmental conditions change (e.g., vessel traffic, equipment malfunctions);
o. Survey activity information, such as type of survey equipment in operation, acoustic source power output while in operation, and any other notes of significance (i.e., pre-clearance survey, ramp-up, shutdown, end of operations, etc.);

Visual Sighting (all Visual Effort fields plus):

a. Watch status (sighting made by PSO on/off effort, opportunistic, crew, alternate vessel/platform);
b. Vessel/survey activity at time of sighting;
c. PSO/PSO ID who sighted the animal;
d. Time of sighting;
e. Initial detection method;
f. Sightings cue;
g. Vessel location at time of sighting (decimal degrees);
h. Direction of vessel's travel (compass direction);
i. Direction of animal's travel relative to the vessel;
j. Identification of the animal (e.g., genus/species, lowest possible taxonomic level, or unidentified); also note the composition of the group if there is a mix of species;
k. Species reliability;
l. Radial distance;
m. Distance method;
n. Group size; Estimated number of animals (high/low/best);
o. Estimated number of animals by cohort (adults, yearlings, juveniles, calves, group composition, etc.);
p. Description (as many distinguishing features as possible of each individual seen, including length, shape, color, pattern, scars or markings, shape and size of dorsal fin, shape of head, and blow characteristics);
q. Detailed behavior observations (e.g., number of blows, number of surfaces, breaching, spyhopping, diving, feeding, traveling; as explicit and detailed as possible; note any observed changes in behavior);
r. Mitigation Action; Description of any actions implemented in response to the sighting (e.g., delays, shutdown, ramp-up, speed or course alteration, etc.) and time and location of the action.
s. Behavioral observation to mitigation;
t. Equipment operating during sighting;
u. Source depth (in meters);

   v. Source frequency;
   w. Animal's closest point of approach and/or closest distance from the center point of the acoustic source;
   x. Time entered shutdown zone;
   y. Time exited shutdown zone;
   z. Time in shutdown zone;
   aa. Photos/Video
2. The project proponent must submit a final monitoring report to BOEM and NMFS (to *renewable_reporting@boem.gov* and *nmfs.gar.incidental-take@noaa.gov*) within 90 days after completion of survey activities. The report must fully document the methods and monitoring protocols, summarizes the survey activities and the data recorded during monitoring, estimates of the number of listed species that may have been taken during survey activities, describes, assesses and compares the effectiveness of monitoring and mitigation measures. PSO sightings and effort data and trackline data in Excel spreadsheet format must also be provided with the final monitoring report.
3. Reporting sightings of North Atlantic right whales:
   a. If a North Atlantic right whale is observed at any time by a PSO or project personnel during surveys or vessel transit, sightings must be reported within two hours of occurrence when practicable and no later than 24 hours after occurrence. In the event of a sighting of a right whale that is dead, injured, or entangled, efforts must be made to make such reports as quickly as possible to the appropriate regional NOAA stranding hotline (from Maine-Virginia report sightings to 866-755-6622, and from North Carolina-Florida to 877-942-5343). Right whale sightings in any location may also be reported to the U.S. Coast Guard via channel 16 and through the WhaleAlert App (http://www.whalealert.org/).
   b. Further information on reporting a right whale sighting can be found at: *https://apps-nefsc.fisheries.noaa.gov/psb/surveys/documents/20120919_Report_a_Right_Whale.pdf*
4. In the event of a vessel strike of a protected species by any survey vessel, the project proponent must immediately report the incident to BOEM (*renewable_reporting@boem.gov*) and NMFS (*nmfs.gar.incidental-take@noaa.gov*) and for marine mammals to the NOAA stranding hotline: from Maine-Virginia, report to 866-755-6622, and from North Carolina-Florida to 877-942-5343 and for sea turtles from Maine-Virginia, report to 866-755-6622, and from North Caroline-Florida to 844-732-8785. The report must include the following information:
   a. Name, telephone, and email or the person providing the report;
   b. The vessel name;
   c. The Lease Number;
   d. Time, date, and location (latitude/longitude) of the incident;
   e. Species identification (if known) or description of the animal(s) involved;
   f. Vessel's speed during and leading up to the incident;
   g. Vessel's course/heading and what operations were being conducted (if applicable);
   h. Status of all sound sources in use;

i. Description of avoidance measures/requirements that were in place at the time of the strike and what additional measures were taken, if any, to avoid strike;
j. Environmental conditions (wave height, wind speed, light, cloud cover, weather, water depth);
k. Estimated size and length of animal that was struck;
l. Description of the behavior of the species immediately preceding and following the strike;
m. If available, description of the presence and behavior of any other protected species immediately preceding the strike;
n. Disposition of the animal (e.g., dead, injured but alive, injured and moving, blood or tissue observed in the water, last sighted direction of travel, status unknown, disappeared); and
o. To the extent practicable, photographs or video footage of the animal(s).

5. Sightings of any injured or dead listed species must be immediately reported, regardless of whether the injury or death is related to survey operations, to BOEM (*renewable_reporting@boem.gov*), NMFS (*nmfs.gar.incidental-take@noaa.gov*), and the appropriate regional NOAA stranding hotline (from Maine-Virginia report sightings to 866-755-6622, and from North Carolina-Florida to 877-942-5343 for marine mammals and 844-732-8785 for sea turtles). If the project proponent's activity is responsible for the injury or death, they must ensure that the vessel assist in any salvage effort as requested by NMFS. When reporting sightings of injured or dead listed species, the following information must be included:
   a. Time, date, and location (latitude/longitude) of the first discovery (and updated location information if known and applicable);
   b. Species identification (if known) or description of the animal(s) involved;
   c. Condition of the animal(s) (including carcass condition if the animal is dead);
   d. Observed behaviors of the animal(s), if alive;
   e. If available, photographs or video footage of the animal(s); and
   f. General circumstances under which the animal was discovered.
6. Reporting and Contact Information:
   a. Dead and/or Injured Protected Species:
      1. NMFS Greater Atlantic Region's Stranding Hotline: 866-755-6622
      2. NMFS Southeast Region's Stranding Hotline: 877-942-5343 (marine mammals), 844-732-8785 (sea turtles)
   ii. Injurious Takes of Endangered and Threatened Species:
      1. NMFS Greater Atlantic Regional Office, Protected Resources Division (*nmfs.gar.incidental-take@noaa.gov*)
      2. BOEM Environment Branch for Renewable Energy, Phone: 703-787-1340, Email: *renewable_reporting@boem.gov*