Wind Energy Commercial Lease on the Atlantic Outer Continental Shelf Offshore Maine Essential Fish Habitat Assessment

For the National Marine Fisheries Service
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U.S. Department of the Interior
Bureau of Ocean Energy Management
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List of Acronyms

Acronym	Definition
ADCP	Acoustic Doppler Current Profiler
BMP	best management practice
BOEM	Bureau of Ocean Energy Management
BSEE	Bureau of Safety and Environmental Enforcement
CFR	Code of Federal Regulations
COP	construction and operations plan
CPT	cone penetration test
EFH	Essential Fish Habitat
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FMP	fishery management plan
FR	*Federal Register*
GAA	geographic analysis area
HAPC	Habitat Area of Particular Concern
HMA	Habitat Management Area
HRG	high-resolution geophysical
MAFMC	Mid-Atlantic Fishery Management Council
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NEFMC	New England Fishery Management Council
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
OCS	Outer Continental Shelf
PCD	Project Design Criteria
ROW	right-of-way
RUE	right-of-use easement
SAP	site assessment plan
SOC	standard operating condition
SPI	sediment profile imaging
U.S.C.	United States Code
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
WEA	wind energy area

1 Introduction

In the Magnuson-Stevens Fishery Conservation and Management Act (MSA), Congress recognized that one of the greatest long-term threats to the viability of commercial and recreational fisheries is the continuing loss of marine, estuarine, and other aquatic habitats. Congress also determined that habitat considerations should receive increased attention for the conservation and management of fishery resources of the United States. As a result, one of the purposes of the MSA is to promote the protection of essential fish habitat (EFH) in the review of projects conducted under federal permits, licenses, or other authorities that affect or have the potential to affect such habitat.

The MSA requires federal agencies to consult with the Secretary of Commerce, through the National Marine Fisheries Service (NMFS), with respect to "any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken, by such agency that may adversely affect any EFH identified under this Act" (16 United States Code [U.S.C.] 1855(b)(2)). This process is guided by the requirements of the EFH regulation at 50 Code of Federal Regulations (CFR) 600.905. The Bureau of Ocean Energy Management (BOEM) will be the lead federal agency for the consultation and will coordinate with any other federal agencies that may be issuing permits or authorizations for this Project, as necessary, for one consultation that considers the effects of all relevant federal actions, including in offshore and inshore coastal environments (e.g., issuance of permits by the U.S. Army Corps of Engineers [USACE]).

Pursuant to the MSA, each Fishery Management Plan (FMP) must identify and describe EFH for the managed fishery, and the statute defines EFH as "those waters and substrates necessary to fish for spawning, breeding, feeding or growth to maturity" 16 U.S.C. 1853(a)(7) and 1802(10). The National Oceanic and Atmospheric Administration's (NOAA's) regulations further define EFH, adding that "waters" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle.

The EFH final rule published in the *Federal Register* (*FR*) on January 17, 2002, defines an adverse effect as: "any impact which reduces the quality and/or quantity of EFH." The rule further states that:

> An adverse effect may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat and other ecosystems components, if such modifications reduce the quality and/or quantity of EFH. The EFH final rule also states that the loss of prey may have an adverse effect on EFH and managed species. As a result, actions that reduce the availability of prey species, either through direct harm or capture, or through adverse impacts on the prey species' habitat may also be considered adverse effects on EFH. Adverse effects on EFH may result from action occurring within EFH or outside EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.

The Energy Policy Act of 2005, Public Law No. 109-58, added Section 8(p)(1)(C) to the Outer Continental Shelf Lands Act, which grants the Secretary of the Interior the authority to issue leases, easements, or rights-of-way on the Outer Continental Shelf (OCS) for the purpose of renewable energy development (43 U.S.C. 1337(p)(1)(C)). The Secretary delegated this authority to the former Minerals Management Service, now BOEM. On April 22, 2009, BOEM (formerly the Bureau of Ocean Energy Management, Regulation, and Enforcement) promulgated final regulations implementing this authority at 30 CFR 585. Relevant regulations regarding EFH include the MSA.

This EFH assessment has been prepared pursuant to the MSA, as amended by the Sustainable Fisheries Act of 2007 (16 U.S.C. 1801-1884) to evaluate the potential effects of the site assessment and characterization activities described herein on EFH and EFH species under the jurisdiction of the NMFS.

2 Proposed Action

The Proposed Action is the issuance of wind energy commercial leases and site characterization and site assessment activities within all or some of the Maine Wind Energy Area (WEA) and granting of rights-of-way (ROWs) and rights-of-use and easements (RUEs) in support of wind energy development in the WEA. The potential project easements would all be located within the Gulf of Maine and include corridors that extend from the lease area to the onshore energy grid. The WEA totals approximately 2.0 million acres (8,094 square kilometers) and is located between 20 and 76 nautical miles (37 and 141 kilometers) from shore. For the purposes of impact assessment, BOEM is assuming lease areas of approximately 80,000 acres (324 square kilometers) each, with a maximum of 15 lease areas (for a total of up to 1,200,000 acres [4,856 square kilometers] across all leases).

The Proposed Action would result in site assessment activities on the lease areas and site characterization activities (**Table 2-1**) in and around the lease areas and potential project easements. Site assessment activities include the temporary placement (i.e., deployment, maintenance, and decommissioning) of a meteorological ocean buoy (met buoy). Site characterization activities include geophysical, geotechnical, biological, and archaeological surveys and monitoring activities.

BOEM has decided to include a condition in the proposed Gulf of Maine WEA leases to require lessee compliance with the Project Design Criteria (PDC) and Best Management Practices (BMPs) for data collection activities to minimize impacts to wildlife with a focus on marine protected species. BOEM acknowledges that while an individual Gulf of Maine lessee may opt to carry out biological surveys to characterize resources in their lease area to inform their Construction and Operations Plan (COP) development, there is not an affirmative requirement to carry out any fisheries survey plans yet developed, thus any such surveys are not reasonably certain to occur and effects at this time are unknowable. A condition of the proposed lease would require appropriate consultation prior to carrying out any such fisheries surveys. Additionally, this analysis does not consider construction and operation of any commercial wind power facilities, which would be evaluated if a lessee were to submit a COP.

To measure the speed and direction of ocean currents, Acoustic Doppler Current Profilers (ADCPs) would likely be installed on met buoys or the ocean floor. The ADCP is a remote sensing technology that transmits sound waves at a constant frequency and measures the ricochet of the sound wave off fine particles or zooplankton suspended in the water column. The ADCPs may be mounted independently on the seafloor or attached to a buoy. A seafloor mounted ADCP would likely be located near the met buoy (within approximately 500 feet [152 meters]) and connected by a wire that is buried into the ocean bottom. A typical ADCP has 3 to 4 acoustic transducers that emit and receive acoustical pulses from different directions, with frequencies ranging from 300 to 600 kilohertz (kHz) and a sampling rate of 1 to 60 minutes. A typical ADCP is about 1 to 2 feet (0.3 to 0.61 meters) tall and 1 to 2 feet (0.3 to 0.61 meters) wide. Its mooring, base, or cage (surrounding frame) would be several feet wider.

A seafloor mounted ADCP would likely be located near the met buoy (within approximately 500 feet [152 meters]). In the highly unlikely scenario that a bottom-mounted ADCP requires wiring in the Gulf of Maine WEA, the wire would be hand-buried adjacent to the mooring of met-ocean equipment. Trenching or scour protection of the ADCP wire is not part of the proposed action. A typical ADCP has 3 to 4 acoustic transducers that emit and receive acoustical pulses from different directions, with frequencies ranging from 300 to 600 kilohertz (kHz) and a sampling rate of 1 to 60 minutes. BOEM anticipates up to two ADCPs per lease area could be deployed. The anticipated footprint for a bottom-mounted ADCP and TRBM are in the 4-6 ft by 2-4 ft range.

A met buoy could also accommodate environmental monitoring equipment such as avian monitoring equipment (e.g., thermal imaging cameras, Motus receivers), acoustic monitoring for marine mammals, data logging computers, visibility sensors, water measurements (e.g., temperature, conductivity salinity), and communications equipment.

The timing of lease issuance, as well as weather and sea conditions, would be the primary factors influencing timing of site characterization and site assessment activities. It is assumed that lessees would begin survey activities as soon as possible after receiving a lease and preparing plans for submission to BOEM, and when sea states and weather conditions allow for site characterization and site assessment activities. The most suitable sea states and weather conditions would occur from late spring through early fall (roughly April to August). During this time, the Gulf of Maine tends to experience more stable weather patterns with warmer temperatures and calmer seas. Lessees have up to 5 years to perform site characterization activities before they must submit a COP (30 CFR § 585.235(a)(2))[1]. Lease sales in the Gulf of Maine are anticipated to occur in two phases.

- Leasing Phase 1: Under the reasonably foreseeable site characterization scenario, the sale date for up to 10 leases is planned for October 29, 2024, and the Final Sale Notice is to be published 45 days prior. BOEM could issue leases as early as late 2024 and continue through mid-2025. For leases issued in October through December 2024, the earliest surveys would likely begin no sooner than April 2025. Lessee's surveys for leases issued in October through December 2024 could continue through August 2029 prior to submitting their COPs.
- Leasing Phase 2: Under the reasonably foreseeable site characterization scenario, a second lease sale would be held in 2028. BOEM could issue leases as early as early 2028 and continue through late 2028. For leases issued after July 2028, the earliest surveys would likely begin no sooner than April 2029. Lessee's surveys for leases issued in 2028 could continue through 2033 prior to submitting their COPs.

The issuance of a lease by BOEM to the lessee conveys no right to proceed with development of a wind energy facility; the lessee acquires only the exclusive right to submit one or more plans to conduct this activity. Prior to the approval of any plan authorizing the construction and operation of wind energy-related research facilities, BOEM would prepare a plan-specific environmental analysis and would comply with all required consultation requirements.

Under the Proposed Action, BOEM would require each lessee to avoid or minimize potential impacts on the environment by complying with various requirements. These requirements, which are summarized in **Section 6**, are referred to as standard operating conditions (SOCs) and mitigation and would be implemented through lease stipulations.

[1] BOEM regulations currently require lessees to submit a SAP, which must include data from site characterization surveys (30 CFR § 585.605). BOEM and BSEE's proposed Renewable Energy Modernization Rule, published on January 30, 2023 (88 FR 5968) would eliminate the SAP requirement for met buoys because the SAP process is duplicative with USACE's long-standing permitting process under Section 404(e) of the Clean Water Act (33 USC 1344(e)) and Section 10 of the Rivers and Harbors Act of 1899 (33 USC 401 et seq.) for the installation of met buoys, which are categorized by the USACE as scientific measurement devices. (The proposed rule can be found at Renewable Energy Modernization Rule).

2.1 Geographic Analysis Area

The Gulf of Maine is among the most diverse and productive temperate marine environments in the world. Covering a wide geographical range from Cape Cod Bay in Massachusetts all the way north to the Canadian border and the Bay of Fundy, the Gulf of Maine contains many unique features.

BOEM used a localized geographic analysis area (GAA) to evaluate impacts from the Proposed Action for resources that are fixed in nature (i.e., their location is stationary such as benthic and archaeological resources), or for resources where impacts from the Proposed Action would only occur in waters in and directly around the Commercial Lease Area and other survey areas. GAAs for resources that are highly mobile (e.g., finfish) cover broader areas. The GAA for finfish, invertebrates, and EFH includes the entire Gulf of Maine given their highly mobile and, in some cases, migratory nature. It encompasses three Ecological Production Units (Georges Bank, Western-Central Gulf of Maine [or Gulf of Maine, which includes the cable corridor and final WEA], and Scotian Shelf-Eastern Gulf of Maine) and extends to the shoreline of the Atlantic coast of the United States (**Figure 2-1**). Ecological Production Units are defined by NMFS in partnership with the Northeast Fisheries Science Center and represent major areas within bioregions that contain a reasonably well-defined food web/production system.

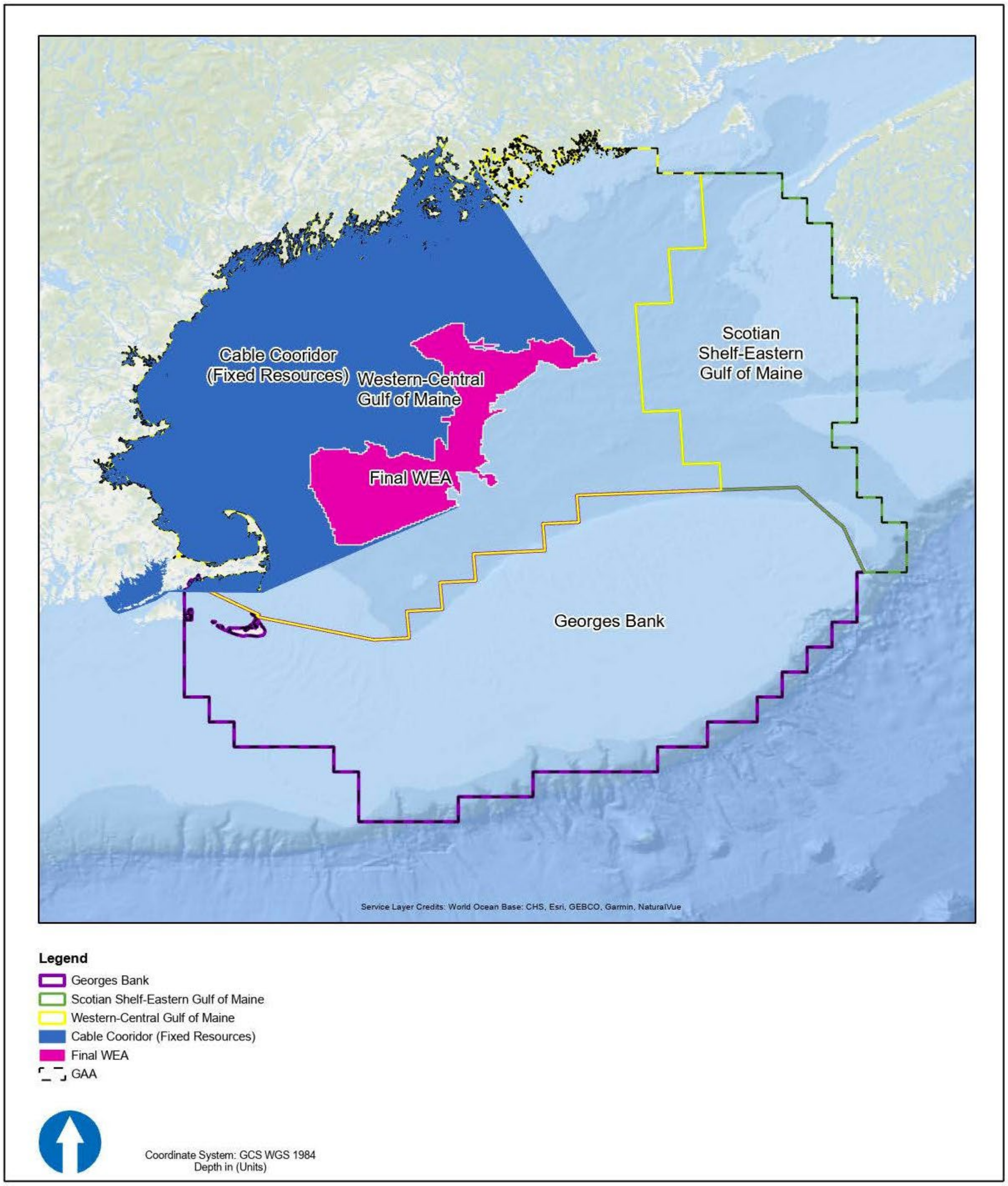

Figure 2-1. Geographic Analysis Area including Ecological Production Units

2.2 Site Assessment and Characterization Activities

The timing of lease issuance, as well as weather, and sea conditions, would be the primary factors influencing the timing of site characterization surveys and site assessment activities. BOEM could begin issuing leases in late 2024 and continue through 2025 with surveys for those leases continuing through 2029. Lessees have a preliminary term of up to 1 year to begin site characterization surveys and submit a site assessment plan (SAP).

Table 2-1. Site assessment and site characterization activities for the Proposed Action

Survey or Monitoring Activity		Description	Activity Frequency and Timing	Port	Vessel Type	Equipment or Method
Site Assessment Activities	Met Buoy[1] –Installation and Maintenance	Met buoys collect and transmit information on wind, waves, currents, sea level, and other meteorological parameters in real time. The anchor for a discus-or boat-shaped hull buoy would weigh between 5,999-10,000 pounds (2,721– 4,536 kilograms) with a footprint of about 5.4 square feet (0.5 square meters) and an anchor chain sweep of about 8.5 acres (34,398 square meters). A spar type buoy would result in a maximum area of disturbance of 0.03 acres (118 square meters). Under current regulations, the lessee must receive BOEM approval of a SAP before installing one or more met buoys.	Transport and installation vessel anchoring for discus- or boat-shaped hull buoys would take 1 day. For spar-type buoys installation would occur in two phases over the course of 3 days. Total vessel round trips for installation are expected to range from 30–60. Vessel round trips for quarterly maintenance visits over the course of 5 years are expected to total 300; 900 vessel round trips are expected if maintenance is performed monthly (over 5 years).	Searsport, ME; Portland, ME; Portsmouth, NH; Boston, MA; Salem, MA; or New Bedford, MA	Crew boat up to 200 feet (61 meters) in length.	Buoys are towed or carried aboard a vessel to the installation location and either lowered to the ocean surface from the deck of the vessel or placed over the final location and the mooring anchor is dropped. On-site inspections and preventative maintenance (e.g., marine fouling, wear, or lens cleaning) are expected to occur on a monthly or quarterly basis. Periodic inspections for specialized components (e.g., buoy, hull, anchor chain, or anchor scour) would occur at different intervals but would likely coincide with the monthly or quarterly inspection to minimize the need for additional boat trips to the site.
	Met Buoy – Decommissioning	Decommissioning is basically the reverse of the deployment process. Equipment recovery would be performed with the support of a vessel equivalent in size and capability to that used for deployment. Typically for small buoys, a crane-lifting hook would be secured to the buoy. A water or air pump system would de ballast the buoy, causing it to tip into the horizontal position. The mooring chain and anchor would be recovered to the deck using a winching system. The buoy would then be transported to shore. Buoy decommissioning is expected to be completed within 1 to 2 days, depending on buoy type.	See previous row. Total vessel round trips for decommissioning are expected to range from 60.	See previous row.	See previous row.	See previous row.
	Passive Acoustic Monitoring (PAM) Buoy –Installation and Maintenance	PAM Buoys collect acoustic data to document the presence of marine mammals and other environmental and anthropogenic sound sources. Four PAM Buoys will be installed within each Lease area (60 total) in much the same way as Met buoy systems.	Total vessel round trips for installation are expected to be 60. Up to 2 vessel round trips per year are expected for maintenance visits over the course of 5 years for a total 300 trips.	Searsport, ME; Portland, ME; Portsmouth, NH; Boston, MA; Salem, MA; or New Bedford, MA	Crew boat up to 200 feet (61 meters) in length.	Installation methodologies will be close to the same techniques and equipment as described for Met buoy deployment systems.
	PAM Buoy – Decommissioning	Decommissioning is basically the reverse of the deployment process.	See previous row. Total vessel round trips for decommissioning are expected to be 60.	See previous row.	See previous row.	See previous row.

Survey or Monitoring Activity		Description	Activity Frequency and Timing	Port	Vessel Type	Equipment or Method
Site Characterization Activities	High-Resolution Geophysical Surveys[2,3]	Site characterization surveys would begin with reconnaissance surveys following the execution of the commercial lease but prior to installing a met buoy. Site characterization surveys would then continue in a phased approach. The surveys would collect bathymetrical (seafloor depth), morphological (topography), and geological data to inform various charting, interpretation, analyses, and reporting, including assessment of shallow hazards and archaeological resources.	For high-resolution geophysical surveys within the cable corridor and the WEA the total number of expected vessel trips utilizing both 12- and 24- hour vessels is 851.	Searsport, ME; Portland, ME; Portsmouth, NH; Boston, MA; Salem, MA; or New Bedford, MA	24-hour vessel, with length of approximately 164 feet (50 meters) for offshore locations. 12-hour vessel, with length of approximately 49 feet (15 meters) for nearshore and inshore locations.	Sub-bottom profiler, side scan sonar, multibeam echosounder, or magnetometer towed from vessel or mounted on an AUV within the water column.
	Geotechnical Surveys and Seafloor Sampling[2,3]	Geotechnical surveys would be performed to assess the suitability of substrate for installation of infrastructure. Geotechnical samples are used to evaluate shallow sediment characteristics for water quality and sediment dispersion monitoring. The area of seabed disturbed by individual sampling events is estimated to range from 11-108 square feet (1–10 square meters)	Three geotechnical samples are expected at every potential WTG and transmission station location for a total of 3,645 samples. One geotechnical sample is expected every kilometer along the transmission cable corridor for a total of 6,149 samples. There are 33 total expected vessel trips associated with geotechnical sampling efforts.	Searsport, ME;Portland, ME; Portsmouth, NH; Boston, MA; Salem, MA; or New Bedford, MA	Vessel with a length of approximately 246–262 feet (75–80 meters).	Shallow geotechnical coring (piston or vibracores), deep borings, and cone penetration testing.
	Biological (Benthic) Surveys[3]	The surveys would be used to characterize seafloor habitats. Benthic sampling could also include nearshore, estuarine, and SAV habitats along the cable corridors.	Will occur concurrently with geotechnical sampling. One benthic sample is expected every kilometer along the transmission cable corridor for a total of 6,149 samples, three benthic samples will be collected at each WTG totaling 3645 and one benthic sample is expected at each Met buoy and PAM buy site for a total of 90 samples. There are 16 total expected vessel trips associated with benthic sampling efforts.	Searsport, ME; Portland, ME; Portsmouth, NH; Boston, MA; Salem, MA; or New Bedford, MA	See geophysical reconnaissance and G&G surveys.	Bottom sediment (grab samples)/fauna sampling, benthic sled, and underwater imagery/sediment profile imaging.
	Biological (Avian/Bat, Marine Mammals, Sea Turtles) Surveys	The results of biological surveys are required to describe the key species and habitat within the survey area possibly affected by the Proposed Action.	36 surveys for vessel based (including PAM surveys) and 36 aerial based surveys are expected for each lease area. Avian surveys may be conducted in a minimum of 2 years. There are 540 total expected vessel trips associated with the visual wildlife surveys.	Searsport, ME; Portland, ME; Portsmouth, NH; Boston, MA; Salem, MA; or New Bedford, MA	To be inserted	Visual observations from boats, airplanes, or remote operated drones; passive acoustic monitors mounted on AUVs, drones, or vessels (for marine mammals and sea turtles). For bat surveys, ultrasonic detectors would be installed on survey vessels being used for other biological surveys.

[1] A met buoy could also accommodate environmental monitoring equipment such as avian monitoring equipment (e.g., thermal imaging cameras, Motus receivers), acoustic monitoring for marine mammals, data logging computers, visibility sensors, water measurements (e.g., temperature, conductivity salinity), remote sensing technology (e.g., ADCP) and communications equipment.
[2] All manned vessels would have trained observers onboard to monitor for impacts on marine mammals and wildlife. Unmanned surface vessels, if used, would have trained observers onshore, monitoring cameras and sensors on the unmanned surface vessels.
[3] Bat ultrasonic detectors may be installed on survey vessels to opportunistically collect seasonal bat activity data within the survey areas, including species occurrence, timing of occurrence, and weather conditions (as recorded by instrumentation on the vessel) at the time of recording. The detectors would be powered by internal batteries and mounted as high as possible on the exterior shipboard side of each vessel's upper deck to enhance bat activity detection and minimize exposure to saltwater and acoustic interference from wave action and other ship operations. It is currently anticipated that the avian and bat acoustic detectors would be Wildlife Acoustics SM4 units.
AUV = autonomous underwater vehicle; BOEM = Bureau of Ocean Energy Management; Met = meteorological; PAM = passive acoustic monitoring; SAP = site assessment plan; SAV = submerged aquatic vegetation.

2.3 Non-routine Events

Reasonably foreseeable non-routine and low-probability events and hazards that could occur during site characterization and site assessment related activities include the following: (1) severe storms, such as hurricanes and extratropical cyclones; (2) allisions and collisions between structures or vessels used for site assessment or site characterization activities and other marine vessels or marine life; (3) spills from collisions or fuel spills resulting from generator refueling; and (4) recovery of lost survey equipment.

Impacts on the Proposed Action from storms, allisions and collisions, and spills have been previously described and analyzed in other relevant National Environmental Policy Act and consulting documents (**Table 2-2**). Although these previous documents do not specifically address the Gulf of Maine area, the assessment of potential impacts presented in those documents applies equally to the Proposed Action as the risks of these events are not materially different in the Gulf of Maine. Accordingly, the potential impacts from non-routine events are described in those EAs and are briefly described below but not analyzed in detail.

Table 2-2. Relevant existing National Environmental Policy Act and consulting documents

Reference	Link
Avanti Corporation, Industrial Economics, Inc. 2019. National Environmental Policy Act documentation for impact-producing factors in the offshore wind cumulative impacts scenario on the North Atlantic continental shelf. Sterling (VA): U.S. Department of the Interior, Bureau of Ocean Energy Management. 201 p. Report No.: OCS Study BOEM 2019-036.	National Environmental Policy Act Documentation for Impact-Producing Factors in the Offshore Wind Cumulative Impacts Scenario on the North Atlantic Outer Continental Shelf
MMS (Minerals Management Service). 2007. Programmatic environmental impact statement for alternative energy development and production and alternate use of facilities on the Outer Continental Shelf. Final environmental impact statement. Herndon (VA): U.S. Department of the Interior, Minerals Management Service. 4 vols. Report No.: OCS EIS/EA MMS 2007-046.	Guide to the OCS Alternative Energy Final Programmatic Environmental Impact Statement (EIS)
BOEM (Bureau of Ocean Energy Management). 2021. Project design criteria and best management practices for protected species associated with offshore wind data collection. Sterling (VA): U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Atlantic OCS Region. 18 p.	Project Design Criteria and Best Management Practices for Protected Species Associated with Offshore Wind Data Collection
BOEM (Bureau of Ocean Energy Management). 2022. Decision Memorandum. Gulf of Maine Request for Competitive Interest (RFCI). Washington (DC): U.S. Department of the Interior, Bureau of Ocean Energy Management.	Gulf of Maine Request for Competitive Interest (RFCI)

2.3.1 Storms

Severe weather events have the potential to cause structural damage and injury to personnel. Major storms, winter nor'easters, and hurricanes pass through the area regularly, resulting in elevated water levels (storm surge) and high waves and winds. Storm surge and wave heights from passing storms are worse in shallow water and along the coast but can pose hazards in offshore areas. The Atlantic Ocean hurricane season extends from June 1 to November 30, with a peak in September when hurricanes would be most likely to impact the WEA at some time during the Proposed Action. Storms could increase the likelihood of allisions and collisions that could result in a spill. However, the storm would cause the spill and its effects to dissipate faster, vessel traffic is likely to be significantly reduced before an impending storm, and surveys related to the Proposed Action would be postponed until after the storm had passed. Although storms have the potential to impact met buoys, the structures are designed to withstand storm conditions. Though unlikely, structural failure of a met buoy could result in a temporary hazard to navigation.

2.3.2 Allisions and Collisions

An allision occurs when a moving object (e.g., a vessel) strikes a stationary object (e.g., met buoy); a collision occurs when two moving objects strike each other. Met buoys in the WEA could pose a risk to vessel navigation. An allision between a ship and a met buoy could result in the damage or loss of the buoy or the vessel, as well as loss of life and spillage of petroleum product. Although such an event is considered unlikely, vessels associated with site assessment and site characterization activities could collide with other vessels, resulting in damages, petroleum product spills, or capsizing. Risk of allisions and collisions may be reduced through compliance with U.S. Coast Guard (USCG) Navigation Rules and Regulations, use of navigational aids (e.g. aids to navigation, bridge equipment, charts, informational notices, publications), safe fairways, and traffic separation schemes, for vessels transiting to and from ports primarily in Maine, Massachusetts, and New Hampshire. BOEM anticipates that aerial wildlife surveys, if deemed necessary, would not be conducted during periods of storm activity because the reduced visibility conditions would not meet visibility requirements for conducting the surveys and because flying at low elevations would pose a safety risk during storms and times of low visibility.

Collisions between vessels and allisions between vessels and met buoys are considered unlikely because vessel traffic is controlled by multiple routing measures, such as safety fairways, traffic separation schemes, and anchorages. Areas with higher traffic were excluded from the WEA. BOEM requires the lessee to submit a private aid to navigation application with the USCG for the met buoy. The risk of allisions with met buoys would be further reduced by USCG-approved marking and lighting on the met buoys. The lessee will be responsible for the establishment, operation, maintenance, and discontinuance of the private aid to navigation.

2.3.3 Spills

A spill of petroleum product could occur as a result of hull damage from allisions with a met buoy, collisions between vessels, accidents during the maintenance or transfer of offshore equipment or crew, or natural events (e.g., strong waves or storms). From 2011 to 2021, the average spill size for vessels other than tank ships and tank barges was 95 gallons (360 liters) (USCG 2022); should a spill from a vessel associated with the Proposed Action occur, BOEM anticipates that the volume would be similar.

Diesel fuel is lighter than water and may float on the water's surface or be dispersed into the water column by waves. Diesel would be expected to dissipate very rapidly, evaporate, and biodegrade within a few days (MMS 2007). An oil weathering model from NOAA, the Automated Data Inquiry for Oil Spills was used to predict dissipation of a maximum spill of 2,500 barrels (105,000 gallons or 397,468 liters), a spill far greater than what is assumed as a non-routine event during the Proposed Action. Results of the modeling analysis showed that dissipation of spilled diesel fuel is rapid. The amount of time it took to reach diesel fuel concentrations of less than 0.05% varied between 0.5 and 2.5 days, depending on ambient wind (Tetra Tech Inc. 2015), suggesting that 95 gallons (360 liters) would reach similar concentrations much faster and limit the environmental impact of such a spill. Based on the size of the spill, it would be expected to dissipate very rapidly and then evaporate and biodegrade within 1 or 2 days (at most), limiting the potential impacts to a localized area for a short duration.

Vessels are expected to comply with USCG requirements relating to prevention and control of oil spills, and most equipment on the met buoys would be powered by batteries charged by small wind turbines and solar panels. BOEM expects that each of the vessels involved with site characterization and site assessment activities would minimize the potential for a release of oils or chemicals in accordance with 33 CFR part 151, 33 CFR Part 154, and 33 CFR Part 155, which contain guidelines for implementation and enforcement of vessel response plans, facility response plans, and shipboard oil pollution emergency plans.

2.3.4 Recovery of Lost Survey Equipment

Equipment used during site characterization and site assessment activities (e.g., towed high-resolution geophysical [HRG] survey equipment, cone penetration test [CPT] components, grab sampler, buoys, lines, cables) could be accidentally lost during survey operations. Additionally, it is possible (although unlikely) that a met buoy could disconnect from the clump anchor. In the event of lost equipment, recovery operations may be undertaken to retrieve the equipment. Recovery of lost survey equipment is a newly identified non-routine event not found in many previous National Environmental Policy Act or consulting documents (**Table 2-2**) and is therefore carried forward for analysis in this EFH assessment.

Recovery operations may be performed in a variety of ways depending on the equipment lost. A commonly used method for retrieval of lost equipment on the seafloor is dragging grapnel lines (e.g., hooks, trawls). A single vessel deploys a grapnel line to the seafloor and drags it along the bottom until it catches the lost equipment, which is then brought to the surface for recovery. This process can result in significant bottom disturbances because it requires dragging the grapnel line along the bottom until it hooks the lost equipment, which may require multiple passes in a given area. Additional disturbance could come after the line catches the lost equipment, when it drags all the components along the seafloor until recovery.

Marine debris, such as lost survey equipment, that cannot be retrieved because either it is small or buoyant enough to be carried away by currents or it is completely or partially embedded in the seafloor could create a potential hazard for bottom-tending fishing gear or cause additional bottom disturbance. For instance, a broken vibracore rod that cannot be retrieved may need to be cut and capped 3.3 to 6.6 feet (1 to 2 meters) below the seafloor. For the recovery of marine debris, BOEM or the Bureau of Safety and Environmental Enforcement (BSEE) will work with the lessee/operator to develop a recovery plan as described in the NMFS Programmatic Endangered Species Act (ESA) consultation for data collection activities (Anderson 2021). Selection of a mitigation strategy would depend on the nature of the lost equipment and further consultation may be necessary.

Stressors associated with recovery of marine debris such as lost survey equipment may include vessel traffic, noise and lighting, and routine vessel discharges from a single vessel. Recovery operations may also cause bottom disturbance and habitat degradation.

3 Existing Environment

The Gulf of Maine is the northernmost component of the Northeast Large Marine Ecosystem. It is considered a semi-enclosed sea encompassing 36,000 square miles (93,240 square kilometers) and is bounded by Maine, New Hampshire, Massachusetts, New Brunswick, and Nova Scotia. Its complex geological, bathymetric, and oceanographic features support high levels of primary and secondary productivity, making it one of the most productive regions of all the world's oceans (Thompson 2010). Cold and nutrient-dense Scotian Shelf waters from the Labrador Current enter the Gulf of Maine through the Northeast Channel, which sets up a generalized counterclockwise circulation that is bounded by Georges Bank to the south; Maine Coastal Current waters exit via the Great South Channel (Thompson 2010).

The affected environment includes the entire WEA and the area encompassing all potential cable routes. The WEA totals approximately 2.0 million acres (8,094 square kilometers) and is located between 20 and 76 nautical miles (37 and 141 kilometers) from shore. For the purposes of impact assessment, BOEM is assuming lease areas of approximately 80,000 acres 324 square kilometers) each, with a maximum of 15 lease areas.

Georges Bank is located within the southwest portion of the WEA. Due to its shallow and well-mixed waters, Georges Bank is unique and known for high primary productivity as an offshore region. The high concentrations of chlorophyll a on the Bank are like those found in near shore regions of the continental shelf (NEFSC 2021; Fogarty and Murawski 1998) and supports an extensive food web including Atlantic cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinnus*), and sea scallop (*Placopectin magellanicus*) among many others. In addition, the southeastern portion of Georges Bank (Nantucket Shoals) forms an important feeding ground for North Atlantic Right whales (O'Brien et al. 2022; Hayes 2022) and other marine mammals.

Tidal-driven mixing is pronounced in the Gulf of Maine, especially in the Bay of Fundy. Freshwater influx from 60 rivers drain into the Gulf of Maine. Together, these features sustain high levels of biodiversity in the Gulf of Maine, with waters that are used seasonally and year-round by several ESA-listed marine species and other species of commercial, economic, and cultural value; over 3,000 marine species and birds utilize habitat within the Gulf of Maine. However, the Gulf of Maine's biological diversity is particularly vulnerable to rapidly changing physical and chemical conditions because of global climate change.

3.1 Water Quality

The Maine Department of Environmental Protection, Marine Environmental Monitoring Program was established in 1991 to monitor the "extent and effect of industrial contaminants and pollutants on marine and estuarine ecosystems and to determine compliance with and attainment of water quality standards" (38 Maine Revised Statutes 410-F). The State has three water quality classes for marine and estuarine waters—SA, SB, and SC—listed in order from highest to lowest quality (38 Maine Revised Statutes 465 B). Classification is based on monitoring of ambient water quality, nutrients, and eutrophication indicators. Most marine and coastal waters are classified as SB (mid-quality), with intermittent areas along less-developed portions of the Gulf of Maine coastline and islands classified as SA (highest quality); and localized areas at the outlets of industrialized or nutrient-rich watersheds classified as SC (lowest quality) (Maine Department of Environmental Protection 2024).

Water quality in the Gulf of Maine is affected by contaminants entering the marine environment through a variety of sources, including runoff, sewage, and industrial discharges. The presence of contaminants in coastal and marine waters acts as a stressor to biological communities and poses health risks to humans from exposure to contaminated shellfish and water. The effects of human activity on water quality in the Gulf of Maine increased after European colonization and subsequent expansion of fishing and logging activity in the late 1700s and were further intensified with growth in coastal populations and development of industries such as logging operations, sawmills, fish processing plants, private septic systems, municipal sewage plants, pulp mills, and agricultural drainage and aquaculture operations. There are an estimated 2,024 active point sources of contaminants in the Gulf of Maine region, including 378 wastewater treatment plants and 93 power plants (Gulf of Maine Association 2023).

The contaminants of greatest concern for the Gulf of Maine region are sewage, nutrients, mercury, and microbial pathogens (bacteria, viruses, and protozoa) (Jones 2011; Harding and Burbidge 2013).

3.2 Benthic Resources

The affected environment includes the WEA as well as nearshore and estuarine waters along the Maine coast (**Figure 4-1**). From tidal areas to roughly 9 nautical miles (17 kilometers) (295 feet [90 meters] in water depth) the sediment is rocky with sand and gravel deposits, including the Kennebec paleo-delta. Muddy sediment deposits are also observed over large areas. High relief features exist beyond the 9 nautical miles (17 kilometers) (Burgess 2022). The predominant sediment type within the WEA is silt (0.002 to 0.06 millimeters). This area is generally flat with depressions and slopes, with water depths ranging from 518 to 620 feet (158 to 189 meters) (Petony 2022).

The habitats within the WEA may also support deep-sea corals and sponges. Unlike shallow-water corals which require sunlight, deep-sea corals and sponges are suspension-feeders that rely on planktonic and organic matter to obtain their energy. Octocorals, including sea pens, are common in colder and deeper waters. In 2014, octocoral garden communities were discovered in the northern Gulf of Maine in water depths of 200 to 250 meters (Auster et al. 2013, 2015; NOAA Fisheries 2018). Dense aggregations of one or more species of deep-sea octocorals are referred to as coral gardens (Fountain et al., 2019). Known coral reef protected areas and deep-sea coral and sponge habitat observations are shown in **Figure 3-1**. Many coral species function as ecosystem engineers and provide habitat for many other species, including juvenile fish. Recent surveys allude to the fact that coral presence may be higher than expected, despite benthic disturbance from nearby fishing activities such as bottom-trawling and dragging. NOAA's Deep-Sea Coral Research and Technology Program compiles a national database of the known locations of deep-sea corals and sponges in U.S. waters (NOAA 2023; Hourigan et al. 2015). However, there is currently no information available on the presence or absence of these features within the WEA (Pentony 2022). The Maine Coastal Mapping Initiative routinely conducts surveys within the Gulf of Maine including Casco Bay, particularly since 2015 (Benson and Enterline 2021; Dobbs 2017). The surveys conducted in 2015 and 2016 encompassed or were nearby to the WEA (Kennebec paleo-delta) and covered approximately 57 square miles (148 square kilometers) of the seafloor, along with benthic samples at 54 locations (Dobbs 2017). Dobbs (2017) found that sand was the most common sediment type found, with 83 percent of the samples containing more than 20 percent sand and 51 percent predominantly sand, according to Folk classifications. The samples nearshore at a depth of 164 feet (50 meters) or less generally had the greatest sand concentration (Dobbs 2017). Gravel-sized particles were also common in the southern and eastern regions of the survey area in depths ranging from 98 to 164 feet (30 to 50 meters) and comprised an average of 11 percent by weight in all the samples (Dobbs 2017).

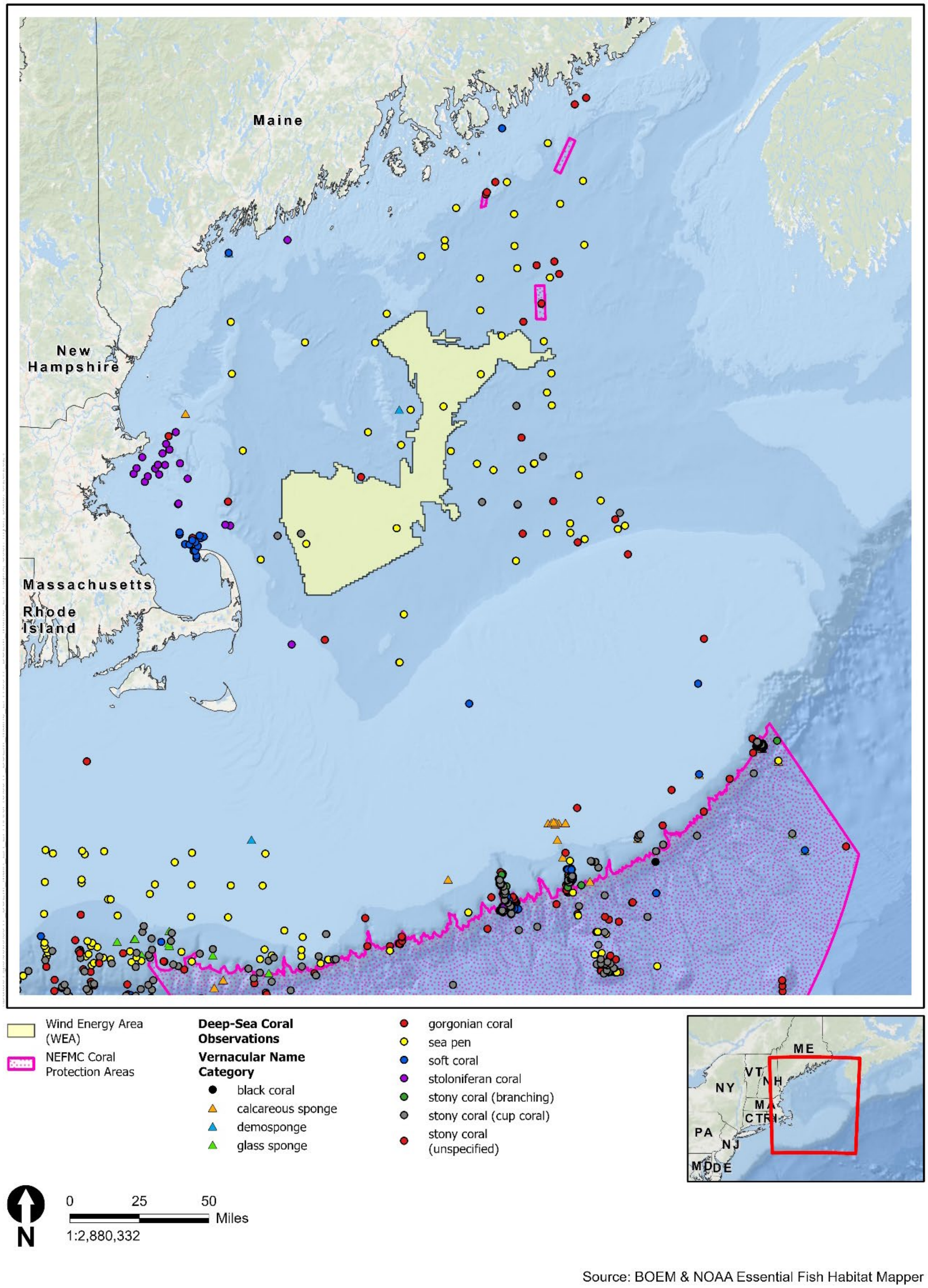

Figure 3-1. NEFMC Coral Reef Protected areas and Deep-Sea Coral and Sponge Habitat Observation Data within the Gulf of Maine Commercial Lease GAA

Nearshore habitats include shallow water estuaries and bays which are mostly soft bottom sediments but also include shellfish beds and submerged aquatic vegetation. These habitats provide food and shelter for high trophic species and boost local biodiversity, while also serving as nursery grounds for local fish species (Stevenson et al. 2014; Kritzer et al. 2016). Stevenson et al. (2014) evaluated the importance of these nearshore habitats for 16 of the most common commercially important species and their prey. Their analysis showed that sand and gravel/cobble habitats are used by most species and life stages, followed by mud, eelgrass, macroalgae, boulder, salt marsh channels, and shell (mussel) beds. Shallow water habitats in the Gulf of Maine provide valuable ecological services for a variety of species. Mud, gravel/cobble, and vegetated habitats are particularly important as juvenile nursery grounds for species such as Atlantic cod (*Gadus morhua*), American lobster (*Homarus americanus*), winter flounder (*Pseudopleuronectes americanus*), soft-shell clams (*Mya arenaria*), and blue mussels (*Mytilus edulis*) (Stevenson et al. 2014). The lobster fishery, dominant in value, license and impact of Maine coastal communities generally targets areas of high seafloor complexity, and transition habitats or edge environments (Burgess 2022). Juvenile lobsters are common in shallow waters, while adults can be found in habitats as deep as 2,297 feet (700 meters), where they are not as dependent on sheltering from predators (Stevenson et al. 2014).

Mussel beds are found in the upper sub-tidal to intertidal coastal zones along the Maine coastline. Beginning from an attachment to a patch of hard substrate or eelgrass, the conspecific aggregations begin to grow as they attach to each other, forming a reef. Oysters (*Crassostrea virginica*) also attach to hard substrates but are not common in the Gulf of Maine (Stevenson et al. 2014). Atlantic sea scallops (*Placopecten magellanicus*), another highly profitable commercial species, are generally found in deeper waters (Fitzgerald 2021).

Eelgrass (*Zostera marina*), the most common species of eelgrass in the Gulf of Maine, takes root in a range of substrates. Most frequently found in mud to coarse sand, eelgrass can even thrive in cobble and boulder habitats as long as there are ample light conditions (Stevenson et al. 2014). Eelgrass, which is typically found in water depths from 3.3 to 26 feet (1 to 8 meters), well outside of the depth range of the WEA and therefore is not expected to be present but could be present in shallow waters along potential transmission line points of interconnection and associated cable routes. Macroalgae are also an important resource to the local food web. Hard bottom macroalgal habitats composed of smaller brown algae (e.g., *Fucus* spp. And *Ascophyllum nodosum*), red algae (e.g., *Phyllophora* spp.) in the intertidal and sub-tidal zones, and kelp beds composed of brown algae (e.g., *Laminaria saccharina*, *Alaria esculenta*, and *Agarum clathratum*).

Based on the Census of Marine Life findings, there are approximately 2,645 named species of invertebrates in the Gulf of Maine (Incze et al. 2010). This includes several managed invertebrate species such as the northern shortfin squid (*Illex illecebrosus*), longfin inshore squid (*Doryteuthis* (*Amerigo*) *pealeii*), and Atlantic sea scallop. Many more invertebrates, such as shrimps, crabs, amphipods, gastropods, and polychaete worms, are not managed but contribute to food webs from offshore or nearshore ecosystems (Malek et al. 2016). The habitats within the WEA may also support deep-sea corals, however there is currently no information available on the presence or absence of these features (Petony 2022).

Benthic resources are subject to pressure from ongoing activities and conditions, especially climate change, commercial fishing using bottom-tending gear (e.g., dredges, bottom trawls, traps/pots), and sediment dredging for navigation. These routine activities are expected to continue for the foreseeable future and would impact benthic habitats and the community composition.

3.3 Finfish, Invertebrates, and EFH

The affected environment encompasses coastal (marine and estuarine) and demersal and pelagic habitats in the open ocean that provides habitat for over 118 finfish families consisting of 252 species (Collette and Klein-MacPhee 2002), and 2,645 named invertebrate species (Incze et al. 2010). This estimate of finfish is limited to a 902 foot (275 meter) bathymetric contour initially set by Bigelow and Schroeder (1953). A general description of the affected environment for the Gulf of Maine is provided in the GAA description in **Section 2.1**. Many finfish and invertebrate species found in the Gulf of Maine are important due to their value as commercial and recreational fisheries.

Several managed invertebrate species occur in the Gulf of Maine, including American lobster, ocean quahogs (*Arctica islandica*), northern shortfin squid, longfin inshore squid, Atlantic sea scallop, deep-sea red crab (*Chaceon quinquedens*), and Jonah crab (*Cancer borealis)*. Other invertebrates, such as copepods, krill, amphipods, isopods, ostracods, mysid shrimp, and unclassified mollusks are managed under the Mid-Atlantic Fishery Management Council's 2016 Unmanaged Forage Species Omnibus Amendment (MAFMC 2017). These managed invertebrate species are important components of the food webs within the offshore and nearshore ecosystems (Malek et al. 2016).

EFH for fish and shellfish resources of the Gulf of Maine WEA were characterized using broad ecological/habitat categories: soft bottom, hard bottom, and pelagic. The offshore analysis area primarily includes EFH for soft bottom species (Atlantic sea scallop, squids, bluefish, hakes, skates, cod, and flatfishes) and several highly migratory species such as Atlantic salmon, tunas, and sharks. Habitat Areas of Particular Concern (HAPC) within the Gulf of Maine include Jeffreys Ledge & Stellwagen Bank HAPC, Cashes Ledge HAPC, Great South Channel Juvenile Cod HAPC, Inshore Juvenile Cod (less than 66 foot [20 meter] depths) HAPC, Northern Edge Juvenile Cod HAPC, and summer flounder (*Paralichthys dentatus*) submerged aquatic vegetation nursery areas. HAPCs for highly migratory species include the Sand Tiger Shark (Plymouth, Tuxbury, Kingston Bay) HAPC (**Figure 4-1**).

The Jeffreys Ledge/Stellwagen Bank HAPC is within the Stellwagen Bank National Marine Sanctuary. The Cashes Ledge HAPC is located in the center of the GAA, adjacent to the proposed WEA. The Great South Channel HAPC is located within the southwestern portion of the GAA, extending from Cape Cod southwards. The Northern Edge Juvenile Cod HAPC is located at the far eastern edge of the GAA, along the northern edge of the Georges Bank. The designated HAPC for Sand Tiger shark is at the very western edge of the GAA (Plymouth, Massachusetts; **Figure 4-1**). The NOAA designated HAPC for inshore juvenile cod is located throughout the Gulf of Maine (**Figure 4-1**). The habitat for juvenile cod includes structurally complex (i.e., eel grass, algae, rocky benthic habitat and contiguous sandy habitats between intertidal areas and the 20-m bathymetric contour throughout the GAA). HAPC for summer flounder is additionally found throughout the Gulf of Maine and includes native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations, within adult and juvenile summer flounder EFH. In locations where native seagrass and macroalgae species have been eliminated from an area, exotic aquatic plant species are included (NOAA Fisheries 2023b).

Three canyon HAPCs fall within the GAA. These canyons are located south of the Georges Bank and offshore of the Mid-Atlantic Bight, along the southern limit of the GAA. These canyon HAPCs include Heezen Canyon HAPC, Hydrographer Canyon HAPC, and Lydonia, Gilbert & Oceanographer Canyons HAPC. Within the GAA are two HAPCs for golden tilefish (*Lopholatilus chamaeleonticeps*). These are located within the larger Lydonia, Gilbert, & Oceanographer Canyons HAPC and include the Lydonia Canyon HAPC and the Oceanographer Canyon HAPC.

Within the Gulf of Maine and the GAA, New England Fishery Management Council (NEFMC) and NOAA Fisheries have designated multiple Habitat Management Areas (HMAs). These HMAs shown on **Figure 4-1** are the Eastern Maine HMA, the Jeffreys Bank HMA, and Cashes Ledge HMA and Groundfish Closure Area, the Ammen Rock HMA, the Fippennies Ledge HMA, the Western Gulf of Maine HMA/Closure Area, the Western Gulf of Maine Shrimp Exemption Area, the Closed Area II Closure Area/Closed Area II Habitat Closure Area, the Mobile Bottom-Tending Gear Closure Area, and the Great South Channel HMA. As depicted on **Figure 4-1**, the GAA encompasses all of these designated HMAs. Potential impacts on HMAs would be in those areas that might be crossed by potential cable routes and survey areas and include the Eastern Maine HMA, the Jeffreys Bank HMA, the Cashes Ledge HMA and Groundfish Closure Area, the Ammen Rock HMA, the Fippennies Ledge HMA, the Western Gulf of Maine HMA/Closure Area, and the Western Gulf of Maine Shrimp Exemption Area. The only other potential impacts on HMAs would be in the Gulf of Maine Cod Protection Closure areas. The Cod Protection Closure Areas are sectors of the Gulf of Maine that extend to and encompass the coastal and nearshore areas (NOAA Fisheries, 2022a) The areas are closed during various periods throughout the year to support Atlantic cod recovery efforts.

Estuarine (inshore) portions of the analysis area are characterized mostly by sedimentary, soft bottom but also support salt marshes, oyster reefs, and mussel beds, as well as stands of eelgrass and kelp beds (Stevenson et al. 2014). Fishes segregate into these habitats by species and life stages. Managed species present in inshore waters include squids, cunner (*Tautogolabrus adspersus)*, tautog (*Tautoga onitis*), bluefish (*Pomatomus saltatrix*), summer flounder, and winter flounder (Stevenson et al. 2014). Many of these species are present as juveniles or subadults. Inshore habitats of the region are productive and support common prey species such as shrimps, bay anchovy (*Anchoa mitchilli)*, Atlantic herring (*Clupea harengus*), Atlantic menhaden (*Bevoortia tyrannus*), butterfish (*Peprilus triacanthus*), killifishes, and Atlantic silversides (*Menidia menidia)* (Raposa and Schwartz 2009, Lapointe 2013).

Finfish, invertebrates, and EFH in the Gulf of Maine are subject to pressures from ongoing activities, especially harvest, bycatch, dredging and bottom trawling, and climate change (NOAA Fisheries 2023b, Lapointe 2013, Gustavson, 2011). Climate change is also predicted to affect U.S. northeast fishery species (Hare et al. 2016) and the Gulf of Maine particularly; some stocks may increase habitat, and some may see habitat reduced. Dredging for navigation, marine minerals extraction, and/or military uses, as well as commercial fishing using bottom trawls and dredge fishing methods (sea scallops), disturbs seafloor habitat on a recurring basis. Commercial and recreational fishing using other methods results in mortality of finfish and invertebrates through harvest and bycatch. In the most recent ecosystem evaluation for the Gulf of Maine (31 December 2022), no managed species were reported as overfished (NOAA Fisheries 2022b).

4 Designated EFH

EFH is designated for 58 finfish and invertebrate species within the GAA, the potential export cable routes, and coastal habitats (**Appendix A**). Both substrate and water habitats are cited as EFH within both the WEA and areas where export cables could be routed.

Approximately 252 finfish species (Collette and Klein-MacPhee 2002) and approximately 2,645 named invertebrate species (Incze et al. 2010) utilize the coastal (marine and estuarine), demersal and pelagic habitats within the Gulf of Maine. This estimate is limited to a 902 foot (275 meter) bathymetric contour initially set by Bigelow and Schroder (1953). Benthic or pelagic EFH has been designated in the GAA for one or more life stages of the 34 EFH managed species. Species with EFH in the GAA were identified using the NOAA Fisheries EFH Mapper (2023b), NEFMC (2017), Mid-Atlantic Fishery Management Council (MAFMC) FMPs, NOAA Fisheries (2017), and NOAA Fisheries EFH source documents.

4.1 Gulf of Maine Habitat Areas of Particular Concern (HAPC) and Habitat Management Areas (HMA)

The fishery management councils also identify EFH HAPCs and HMAs. HAPCs are discrete subsets of EFH that provide important ecological functions or are especially vulnerable to degradation. No designated HAPCs are located within the WEA; however, the Inshore 20-m Juvenile Cod HAPC, the Great South Channel Juvenile Cod HAPC, the Summer Flounder HAPC, the Cashes Ledge HAPC, and the Jeffreys Ledge/Stellwagen Bank HAPC overlap with potential export cable route and vessel routes to the ports that will support the WEA within the GAA (**Figure 4-1**). For highly migratory species, the HAPC for Sand tiger shark is located in the southern extreme area of the GAA located in the Plymouth, Duxbury, Kingston Bay, Massachusetts area and also overlaps with potential export cable routes and vessel routes (**Figure 4-1**).

No designated HMAs are located within the WEA; however, the Eastern Maine HMA, the Jeffreys Bank HMA, the Cashes Ledge HMA and Closure Area, the Ammen Rock HMA, the Fippennies Ledge HMA, the Western Gulf of Maine HMA and Closure Area, and the Western Gulf of Maine Shrimp Exemption Area overlap with potential export cable routes and vessel routes to the ports that will support the WEA within the GAA (**Figure 4-1**).

4.1.1 Inshore 20-m Juvenile Cod HAPC

The Inshore 20-m Juvenile Cod HAPC is defined as practically continuous along the coasts of Maine, New Hampshire, and Massachusetts extending from the shoreline to 66 feet (20 meters). The HAPC was designated in 2016 through the NEFMC to help protect and preserve complex rocky-bottom habitat that supports a diverse assemblage of emergent epifauna and benthic invertebrates (NEFMC 2017). This habitat within this depth range provides juvenile cod with protection from predation, and a resource to important prey species and is not only important for the first year of development for cod but also functions as a nursey habitat for many other groundfish species within the Gulf of Maine (NEFMC 2017).

4.1.2 Great South Channel Juvenile Cod HAPC

The Great South Channel Juvenile Cod HAPC contains structurally complex gravel, cobble, and boulder habitat which provides important food sources and shelter for juvenile cod. The area contains habitats that are sensitive to bottom trawling and dredging. Most of the area is located offshore, but nearshore portions could be susceptible to current or future coastal development (NEFMC 2017).

4.1.3 Summer Flounder HAPC

Summer flounder HAPC is defined as all native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations, within adult and juvenile summer flounder EFH (MAFMC 2016). If native species of submerged aquatic vegetation are eliminated, then exotic species such as the common reed (*Phragmites australis*) should be protected because of functional value.

Juvenile and adult summer flounder have both been documented as having a preference for sandy habitats (Timmons 1995; Bigelow and Schroeder 1953; Schwartz 1964; Smith 1969) but are also commonly found in mudflats and seagrass beds within coastal bays and estuaries (Packer et al. 1999; MAFMC 1998; Wyanski 1990). In general, adult and older juveniles can be found in shallow, inshore and estuarine waters during the summer and fall and then move offshore to deeper waters in the winter and spring, although some juveniles will remain in the bays and estuaries for the winter (Packer et al. 1999; Smith and Daiber 1977; Able and Kaiser 1994; Reid et al. 1999). Within the GAA, adults and juveniles may utilize habitats within the potential export cable routes during winter months. Impacts of Project activities on juvenile and adult summer flounder HAPC are analyzed in **Section 5**. Summer flounder HAPC has not been spatially defined by NOAA but includes native species of macroalgae, seagrasses, and freshwater and tidal macrophytes within summer flounder EFH.

4.1.4 Cashes Ledge HAPC

The Cashes Ledge HAPC is a unique marine habitat comprised of a series of rocky pinnacles, forming relatively shallow habitat where kelp occurs in high abundance (NEFMC 2017). This HAPC is highly productive and is an important habitat for cod (EFH managed species), wolffish (*Anarhichas lupus*), pollock (*Pollachius virens*) (EFH managed species), and sharks (porbeagle [*Lamna nasus*], basking [*Cetorhinus maximus*], and common thresher [*Alopias vulpinus*] EFH). Fish may aggregate or have higher survival after settlement due to increased availability of shelter and abundant prey. This area is sensitive to anthropogenic stresses, including impacts caused by fishing gear. This area is closed to many types of fishing, as it is both a groundfish closure and a habitat closure (NEFMC 2017).

4.1.5 Heezen Canyon HAPC

This canyon is located south of the Georges Bank and offshore of the Mid-Atlantic Bight, along the southern limit of the GAA. This HAPC is a geologically diverse area that provides nursery habitat for several species, including lobster, crabs, tilefish, and hake, and extends to a maximum depth of 4,921 feet (1,500 meters) (NEFMC 2017).

4.1.6 Hydrographer Canyon HAPC

This canyon is located south of the Georges Bank and offshore of the Mid-Atlantic Bight, along the southern limit of the GAA. This HAPCs is a geologically diverse area that provides nursery habitat for several species, including lobster, crabs, tilefish, and hake, and extends to a maximum depth of 4,921 feet (1,500 meters) (NEFMC 2017).

4.1.7 Jeffreys Ledge/Stellwagen Bank HAPC

The Jeffreys Ledge/Stellwagen Bank HAPC is a diverse marine habitat formed during glacial geomorphological forming processes and includes gravel/cobble substrates, boulder reefs, sand plains, and deep mud basins (NEFMC 2017). This dual HAPC is an important habitat and fishing ground for Atlantic cod (EFH managed species), haddock (EFH managed species), pollock (EFH managed species), cusk (*Brosme brosme*), hake (red [*Urophycis chuss*], white [*Urophycis tenuis*], and silver hake [*Merluccius bilinearis*] EFH), flounders (winter, windowpane [*Scophthalmus aquosus*], yellowtail [*Pleuronectes ferruginea*], and witch flounder [*Glyptocephalus cynoglossu*] EFH), herring (Atlantic herring EFH), and Atlantic mackerel [*Scomber scombr*us] (EFH managed species [NEFMC 2017]).

4.1.8 Lydonia, Gilbert & Oceanographer Canyons HAPC

This canyon is located south of the Georges Bank and offshore of the Mid-Atlantic Bight, along the southern limit of the GAA. This HAPCs is a geologically diverse area that provides nursery habitat for several species, including lobster, crabs, tilefish, and hake, and extends to a maximum depth of 4,921 feet (1,500 meters) (NEFMC 2017).

4.1.9 Lydonia Canyon HAPC

This HAPC for golden tilefish is located within the larger Lydonia, Gilbert & Oceanographer Canyons HAPC. This area comprises clay outcrops that provide habitat for juvenile and adult golden tilefish and are located between 328 to 984 feet (100 and 300 meters) (NEFMC 2017).

4.1.10 Oceanographer Canyon HAPC

This HAPC for golden tilefish is located within the larger Lydonia, Gilbert & Oceanographer Canyons HAPC. This area comprises clay outcrops that provide habitat for juvenile and adult golden tilefish and are located between 328 to 984 feet (100 and 300 meters) (NEFMC 2017).

4.1.11 Northern Edge Juvenile Cod HAPC

This HAPC comprises a bottom of gravel pavement habitat, which has been identified as an important habitat type for juvenile cod survival. This area is closed to many types of fishing (NEFMC 2017).

4.1.12 Sand Tiger Shark HAPC

The designated HAPC for Sand Tiger shark is at the very western edge of the GAA (Plymouth, Massachusetts; **Figure 4-1**). Studies suggest that the area is a seasonal nursery area for neonate and juvenile sand tigers (NEFMC 2017).

4.1.13 Eastern Maine HMA

The Eastern Maine HMA was designated to minimize the adverse effects of fishing on habitats used by juvenile groundfish, including redfish, alewife, silver hake, white hake, windowpane flounder, winter flounder, and witch flounder. Habitats present in this area are vulnerable to fishing impacts. This area is closed year-round to all bottom-tending mobile gears (NEFMC 2017).

4.1.14 Jeffreys Bank HMA

The Jeffreys Bank HMA encompasses both shallower, more complex, hard-bottom habitats and deeper, muddy habitats. This area is closed year-round to all bottom-tending gears (NEFMC 2017).

4.1.15 Cashes Ledge HMA – Cashes Ledge Closure Area

Cashes Ledge is comprised of a series of rocky pinnacles that jut up from the deep basins in the middle of the Gulf of Maine. The area is highly productive with upwelling and waves that deliver fish and invertebrate larvae to the shallow pinnacles where settlement occurs. These benthic habitat features are sensitive to anthropogenic stresses, including impacts caused by fishing gear. This area is currently closed to many types of fishing, as it is both a groundfish closure and a habitat closure (NEFMC 2017).

4.1.16 Ammen Rock HMA

Located within the Cashes Ledge HAPC and HMA, Ammen Rock is a pinnacle of relatively shallow habitat where kelp occurs in high abundance. The combination of sunlight and nutrient-rich waters fuels the growth of one of the largest kelp forests and deepest seaweed communities in the world. This area is closed to all fishing vessels, except those fishing with pots or lobster traps (NEFMC 2017).

4.1.17 Fippennies Ledge HMA

Fippennies Ledge lies within the Cashes Ledge Groundfish Closure Area and contains habitat for haddock. This HMA was designated to protect a representative array of substrate and habitat types while allowing fishing activity along the edges of the features in deeper waters. The area is closed year-round to all bottom-tending mobile gears (NEFMC 2017).

4.1.18 Western Gulf of Maine HMA/Closure Area

This area encompasses the same geographic extent as the Jeffreys Ledge/Stellwagen Bank HAPC and is closed year-round to all but exempt fishing vessels. Bottom-tending mobile gear is also prohibited. The habitat and groundfish closures restrict various types of fishing, including fishing with mobile gears, which reduces the adverse effects to EFH on the seabed within this area (NEFMC 2017).

4.1.19 Western Gulf of Maine Shrimp Exemption Area

This area is in the northwestern corner of the Jeffreys Ledge/Stellwagen Bank HAPC and the Western Gulf of Maine HMA/Closure Area. This area is closed to mobile bottom-tending gear, except shrimp trawls (NEFMC 2017).

4.1.20 Closed Area II Closure Area – Closed Area II Habitat Closure Area

These habitat and groundfish closure areas, which partially overlap the Northern Edge Juvenile Cod HAPC, restrict various types of fishing, including fishing with mobile gears. This reduces the effects to EFH on the seabed in the Georges Bank region (NEFMC 2017).

4.1.21 Mobile Bottom Tending Gear Closure Area

This closure area overlaps the northeastern corner of the Great South Channel HMA and partially overlaps the Great South Channel Juvenile Cod HAPC. This area is completely closed to mobile bottom-tending gear. This closure reduces the adverse effects to EFH on the seabed in this portion of the Great South Channel region (NEFMC 2017).

4.1.22 Great South Channel HMA

The Great South Channel HMA encompasses cobble and boulder-dominated habitat types. This HMA partially overlaps the Great South Channel HAPC. This area allowed a one-year hydraulic clam dredge exemption. Other mobile bottom-tending gears including scallop dredges and trawls are prohibited. The closure of most mobile bottom-tending gear reduces the adverse effects to EFH on the seabed in portion of the Great South Channel (NEFMC 2017).

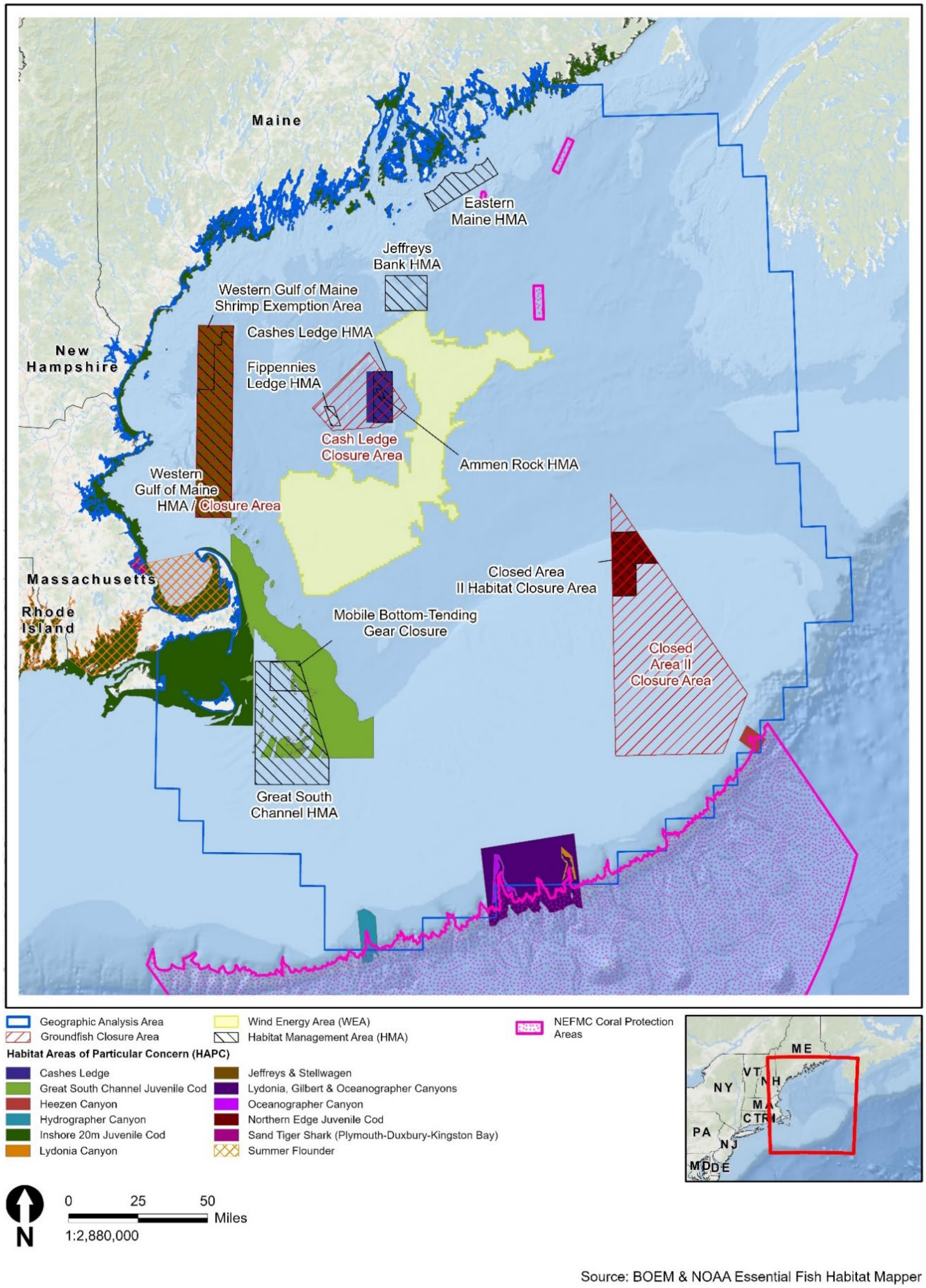

Figure 4-1. HAPCs and HMAs located within the GAA extending from the Head Harbor Island, Maine to Chappaquiddick Island, Massachusetts

4.2 Species Groups

Species groups are groups of EFH species and life history stages that predominantly share the same habitat type. Benthic/epibenthic species groups are sorted into two habitat types (softbottom or complex) based on the benthic habitat with which the species is most typically associated, with the potential for any species to be found in heterogenous complex as that habitat type could include both Softbottom and Complex Habitat.

Prey species are included as species groups because they are consumed by managed fish and invertebrate species as prey, and thus are a component of EFH.

Sessile Benthic/Epibenthic – Softbottom (includes slow-moving benthic/epibenthic species and life stages; could include heterogenous Complex Habitat)

- Atlantic herring – *Clupea harengus* (eggs)
- Atlantic sea scallop – *Placopecten magellanicus* (eggs, juveniles, adults)
- Longfin squid – *Doryteuthis (Amerigo) pealeii* (eggs)
- Ocean quahog – *Artica islandica* (juveniles, adults)
- Skates – Rajidae (eggs)
- Winter flounder – *Pseudopleuronectes americanus* (eggs)

Mobile Benthic/Epibenthic – Softbottom (could include heterogenous Complex Habitat)

- Acadian redfish - *Sebastes fasciatus* (adults)
- American plaice – *Hippoglossoides platessoides* (juveniles, adults)
- Atlantic sea scallop – *Placopecten magellanicus* (eggs, juveniles, adults)
- Barndoor skate – *Dipturus laevis* (juveniles, adults)
- Deep-sea red crab – *Chaceon quinquedens* (eggs, juveniles, adults)
- Little skate – *Leucoraja erinacea* (juveniles, adults)
- Monkfish – *Lophius americanus* (juvenile, adults)
- Ocean pout – *Macrozoarces americanus* (juveniles, adults)
- Red hake – *Urophycis chuss* (juveniles, adults)
- Rosette skate – *Leucoraja garmani* (neonates, juveniles, adults)
- Sand tiger shark – *Carcharias taurus* (neonates, juveniles, adults)
- Sandbar shark – *Carcharhinus plumbeus* (neonates, juveniles, adults)
- Scup - *Stenotomus chrysops* (juveniles, adults)
- Silver hake – *Merluccius bilinearis* (juveniles, adults)
- Smooth skate – *Malacoraja senta* (juveniles, adults)
- Spiny dogfish – *Squalus acanthias* (neonates, juveniles, adults)
- Summer flounder – *Paralichthys dentatus* (juveniles, adults)
- Thorny skate – *Amblyraja radiata* (juveniles, adults)

- White hake – *Urophycis tenuis* (juveniles, adults)
- Windowpane flounder – *Scophthalmus aquosus* (juveniles, adults)
- Winter flounder – *Pseudopleuronectes americanus* (juveniles, adults)
- Winter skate – *Leucoraja ocellata* (juveniles, adults)
- Witch flounder – *Glyptocephalus cynoglossus* (juveniles, adults)
- Yellowtail flounder – *Limanda ferruginea* (juveniles, adults)

Sessile Benthic/Epibenthic – Complex Habitat (includes slow-moving species and life stages; could include heterogenous Complex Habitat)

- Atlantic herring – *Clupea harengus* (eggs)
- Atlantic sea scallop – *Placopecten magellanicus* (larvae)
- Atlantic wolffish – *Anarhichas lupus* (eggs)
- Longfin inshore squid – (*Loligo pealeii*) (eggs)
- Ocean pout – Macrozoarces americanus (eggs)
- Skates – Rajidae (eggs)

Mobile Benthic/Epibenthic – Complex Habitat (could include heterogenous Complex Habitat)

- Acadian redfish – *Sebastes fasciatus* (juveniles)
- American plaice – *Hippoglossoides platessoides* (juveniles, adults)
- Atlantic cod – *Gadus morhua* (juveniles, adults)
- Atlantic herring – *Clupea harengus* (juveniles, adults)
- Atlantic wolffish – *Anarhichas lupus* (larvae, juveniles, adults)
- Black sea bass – *Centropristis striata* (juveniles, adults)
- Golden tilefish – *Lopholatilus chamaeleonticeps* (juveniles, adults)
- Haddock – *Melanogrammus aeglefinus* (juveniles, adults)
- Little skate – *Leucoraja erinacea* (juveniles, adults)
- Monkfish – *Lophius americanus* (juvenile, adults)
- Ocean pout – *Macrozoarces americanus* (juveniles, adults)
- Pollock – *Pollachius virens* (juveniles, adults)
- Red hake – *Urophycis chuss* (juveniles, adults)
- Sand tiger shark – *Carcharias taurus* (neonates, juveniles, adults)
- Sandbar shark – *Carcharhinus plumbeus* (neonates, juveniles, adults)
- Scup – *Stenotomus chrysops* (juveniles, adults)
- Silver hake – *Merluccius bilinearis* (adults)
- Spiny dogfish – *Squalus acanthias* (neonates, juveniles, adults)

- Summer flounder – *Paralichthys dentatus* (juveniles, adults)
- Thorny skate – *Amblyraja radiata* (juveniles, adults)
- White hake – *Urophycis tenuis* (adults)
- Winter flounder – Pseudopleuronectes americanus (adults)
- Yellowtail flounder – *Limanda ferruginea* (adults)

Pelagic

- Acadian redfish - *Sebastes fasciatus* (larvae)
- Atlantic albacore tuna – *Thunnus alalunga* (juveniles, adults)
- American plaice – *Hippoglossoides platessoides* (eggs, larvae,)
- Atlantic blue marlin – Makaira nigricans (juveniles, adults)
- Atlantic bluefin tuna – *Thunnus thynnus* (eggs, juveniles, adults)
- Atlantic butterfish – *Peprilus triacanthus* (eggs, larvae, juveniles, adults)
- Atlantic cod – *Gadus morhua* (eggs, larvae)
- Atlantic herring – *Clupea harengus* (larvae, juveniles, adults)
- Atlantic mackerel – *Scomber scombrus* (eggs, larvae, juveniles, adults)
- Atlantic sea scallop – *Placopecten magellanicus* (larvae)
- Atlantic wolffish - *Anarhichas lupus* (larvae, 1-6 days)
- Basking shark – *Cetorhinus maximus* (neonates, juveniles, adults)
- Bigeye thresher shark – *Alopias superciliosus* (juveniles, adults)
- Bigeye tuna – *Thunnus obesus* (juveniles, adults)
- Black sea bass – *Centropristis striata* (eggs, larvae)
- Bluefish – *Pomatomus saltatrix* (eggs, larvae, juveniles, adults)
- Blue shark – *Prionace glauca* (neonates, juveniles, adults)
- Common thresher shark – *Alopias vulpinus* (juveniles, adults)
- Deep-sea red crab – *Chaceon quinquedens* (larvae)
- Dusky shark – *Carcharhinus obscurus* (neonates, juveniles, adults)
- Golden tilefish – Lopholatilus chamaeleonticeps (larvae)
- Haddock – *Melanogrammus aeglefinus* (eggs, larvae)
- Longbill spearfish – *Tetrapturus pfluegeri* (juveniles, adults)
- Longfin inshore squid – *Loligo pealeii* (juveniles, adults)
- Monkfish – *Lophius americanus* (eggs, larvae)
- Northern shortfin squid – Illex illecebrosus (eggs, juveniles, adults)
- Offshore hake – *Merluccius albidus* (eggs, larvae, juveniles, adults)

- Pollock – *Pollachius virens* (eggs, larvae, juveniles, adults)
- Porbeagle shark – *Lamna nasus* (neonates, juveniles, adults)
- Red hake – *Urophycis chuss* (eggs, larvae)
- Roundscale spearfish – *Tetrapturus georgii* (juveniles, adults)
- Shortfin mako shark – *Isurus oxyrinchus* (neonates, juveniles, adults)
- Silky shark – *Carcharhinus falciformis* (neonates, juveniles, adults)
- Silver hake – *Merluccius bilinearis* (eggs, larvae, juveniles)
- Skipjack tuna – *Katsuwonus pelamis* (eggs, larvae, juveniles, adults)
- Summer flounder – *Paralichthys dentatus* (eggs, larvae)
- Swordfish – *Xiphias gladius* (juveniles, adults)
- Tiger shark – *Galeocerdo cuvier* (juveniles, adults)
- White hake – *Urophycis tenuis* (eggs, larvae)
- White marlin – *Kajikia albida* (juveniles, adults)
- White shark – *Carcharodon carcharias* (juveniles, adults)
- Windowpane flounder – *Scophthalmus aquosus* (eggs, larvae)
- Winter flounder – Pseudopleuronectes americanus (larvae)
- Witch flounder – *Glyptocephalus cynoglossus* (eggs, larvae)
- Yellowfin tun – *Thunnus albacares* (juveniles, adults)
- Yellowtail flounder – *Limanda ferruginea* (eggs, larvae)

Prey Species – Benthic/Epibenthic

- Nematodes
- Polychaetes – Nephytids, Glycerids,
- Crustaceans – amphipods, shrimps, crabs
- Mollusks – bivalves
- Fish – silver hake, sand lance

Prey Species – Pelagic

- Plankton – copepods
- Mollusks – cephalopods (squids), *Loligo* spp.
- Fish – Atlantic herring, clupeids, butterfish

4.3 NOAA Trust Resources

The Atlantic States Marine Fisheries Commission, in cooperation with the states and NOAA Fisheries, manages more than 27 fish and invertebrate species separately from the MSA; many of these species are also identified as NOAA Trust Resources. Of these species, activity related to the Proposed Action may potentially affect those listed in **Table 4-1**.

NOAA Trust Resources have also been identified within the Action Area and potential export cable routes. These resources are summarized in **Table 4-1** and discussed in detail in **Section 7**, *NOAA Trust Resource Species*.

Table 4-1. NOAA Trust Resources within the GAA

Species	Scientific Name	Life Stage Within the Geographic Action Area			
		Egg	Larvae	Juvenile	Adult
American eel	*Anguilla rostrata*	– –	●	●	●
American lobster	*Homarus americanus*	●	●	●	●
American shad	*Alosa sapidissima*	– –	– –	●	●
Atlantic croaker	*Micropogonias undulatus*	●	●	●	●
Atlantic herring	*Clupea harengus*	●	●	●	●
Atlantic menhaden (forage species)	*Bevoortia tyrannus*	– –	●	●	●
Atlantic striped bass	*Morone saxatilis*	– –	– –	●	●
Atlantic sturgeon	*Acipenser oxyrhynchus*	– –	– –	●	●
Black drum	*Pogonias cromis*	– –	– –	●	●
Black sea bass	*Centropristis striata*	– –	– –	●	●
Bluefish	*Pomatomus saltatrix*	– –	– –	●	●
Coastal sharks	various species	– –	– –	●	●
Horseshoe crab	*Limulus polyphemus*	– –	– –	– –	●
Jonah crab	*Cancer borealis*	– –	– –	– –	●
Northern shrimp	*Pandalus borealis*	●	●	●	●
Red drum	*Sciaenops ocellatus*	– –	– –	– –	●
River herring (alewife, blueback herring)	*Alosa pseudoharengus, A. aestivalis*	– –	– –	●	●
Scup	*Stenotomus chrysops*	●	●	●	●
Spiny dogfish	*Squalus acanthias*	– –	– –	●	●
Spot	*Leiostomus xanthurus*	– –	– –	●	●
Spotted seatrout	*Cynoscion nebulosus*	– –	– –	●	●
Summer flounder	*Paralichthys dentatus*	– –	– –	●	●
Tautog	*Tautoga onitis*	– –	– –	●	●
Weakfish	*Cynoscion regalis*	– –	– –	●	●
Winter flounder	*Pleuronectes americanus*	●	●	●	●

– – = life stage is not expected to occur, ● life stage is expected to occur

5 Adverse Effects

This EFH Assessment analyzes the effects of routine activities associated with site assessment activities and site characterization activities (**Table 2-1**) within the WEA and the wider GAA where applicable as defined in **Section 2.1**. This analysis does not consider construction and operation of any commercial wind power facilities, which would be evaluated if a lessee were to submit a COP.

Potential adverse effects on EFH may include noise, seafloor disturbance, entanglement, routine vessel discharges, and vessel traffic and space-use conflicts used by EFH-designated species during specific life stages, and their habitat. If a Project component is likely to result in a short-term (less than 2 years), long-term (2 years to < life of Project), or permanent (life of Project) impairment of designated EFH or HAPC for a managed species and life stage, this would constitute an adverse effect on EFH.

The following sections present and outline the conceivable impacts of the Proposed Action on EFH during site assessment and characterization and decommissioning of the Proposed wind energy research lease and associated potential project easements.

5.1 Site Assessment Activities

5.1.1 Noise

5.1.1.1 Background on Fish and Invertebrate Hearing

Many fishes and invertebrates produce sounds for basic biological functions like attracting a mate and defending territory. A recent study revealed that sound production in fishes has evolved at least 33 times throughout evolutionary time, and that most ray-finned fishes are likely capable of producing sounds (Rice et al. 2022). Fish may produce sounds through a variety of mechanisms, such as vibrating muscles near the swim bladder, rubbing parts of their skeleton together, or snapping their pectoral fin tendons (Ladich and Bass 2011; Rice et al. 2022). Marine invertebrates have been documented producing sounds ranging from the ubiquitous snapping shrimp “snaps” (Johnson et al. 1947) to spiny lobster “rasps” (Patek 2002) to mantis shrimp “rumbles” (Staaterman et al. 2011). Some sounds are also produced as a byproduct of other activities, such as the scraping sound of urchins feeding (Radford et al. 2008a) and even a “coughing” sound made when scallops open and close their shells (Di Iorio et al. 2012).

There are some species that do not appear to produce sounds, but still have acute hearing (e.g., goldfish), which has led scientists to surmise that animals glean a great deal of information about their environment through acoustic cues, a process called “auditory scene analysis” (Fay 2009). All the sounds in a given environment, both natural and human-made, comprise the “soundscape,” or acoustic habitat for that species (Pijanowski et al. 2011). Acoustic habitats naturally vary over space and time, and there is increasing evidence that some fish and invertebrate species can distinguish between soundscapes of different habitats (Kaplan et al. 2015; McWilliam and Hawkins 2013; Radford et al. 2008b). In fact, some pelagic larvae may use soundscapes as a cue to orient towards suitable settlement habitat (Lillis et al. 2013, 2015; Montgomery 2006; Radford et al. 2007; Simpson et al. 2005; Vermeij et al. 2010) or to induce molting into their juvenile forms (Stanley et al. 2015).

All fish and invertebrates can sense the particle motion component of underwater sound. The inner ear of fishes is similar to that of all vertebrates. Each ear has three otolithic end organs, which contain a sensory epithelium lined with hair cells, as well as a dense structure called an otolith (Popper et al. 2021). Particle motion is the displacement, or back and forth motion, of water molecules and as it moves the body of the fish (which has a density similar to seawater), the denser otoliths lag behind, creating a shearing force on the hair cells which sends a signal to the brain via the auditory nerve (Fay and Popper 2000). Many invertebrates have dense structures know as statoliths, which sit within a body of hair cells, and when the animal is moved by particle motion, it results in a shearing force on the hair cells, similar to that described for fish (Budelmann 1992; Mooney et al. 2010). Some invertebrates also have sensory hairs on the exterior of their bodies, allowing them to sense changes in the particle motion field around them (Budelmann 1992); the lateral line in fishes plays a similar role in fish hearing (McCormick 2011). Available research shows that the primary hearing range of most particle-motion sensitive organisms is below 1 kHz (Popper et al. 2021).

In addition to particle motion detection shared across all fishes, some species are also capable of detecting the pressure component of underwater sound (Fay and Popper 2000). Special adaptations of the swim bladder in these species (e.g., anterior projections, additional gas bubbles, or bony parts) bring it in proximity to the ear, and as the swim bladder expands and contracts, pressure signals are radiated within the body of the fish making their way to the ear in the form of particle motion (Popper et al. 2021). These species can typically detect a broader range of acoustic frequencies (up to 3 to 4 kHz; Wiernicki et al. 2020); and are therefore considered to be more sensitive to underwater sound than those that can only detect particle motion. Hearing sensitivity in fishes is generally considered to fall along a spectrum: the least-sensitive (sometimes called "hearing generalists") are those that do not possess a swim bladder and only detect sound through particle motion, limiting their range to sounds below 1 kHz, while the most sensitive ("hearing specialists") possess specialized structures enabling pressure detection which expands their detection frequency range (Popper et al. 2021). A few species in the herring family can detect ultrasonic (>20 kHz) sounds (Mann et al. 2001), but this is considered very rare among the bony fishes. Another important distinction for species that do possess swim bladders is whether it is open or closed; species with open swim bladders can release pressure through a connection to the gut, while those with closed swim bladders can only release pressure very slowly, making them more prone to injury when experiencing rapid changes in pressure (Popper et al. 2019). It should also be noted that hearing sensitivity can change with age; in some species like black sea bass, the closer proximity between the ear and the swim bladder in smaller fish can mean that younger individuals are more sensitive to sound than older fish (Stanley et al. 2020). In other species, hearing sensitivity seems to improve with age (Kenyon 1996).

Compared to other fauna such as marine mammals, research has only begun to understand the importance of sound to fish and invertebrate species, but there is sufficient data thus far to conclude that underwater sound is important to their basic life functions, such as finding a mate, deterring a predator, or defending territory (Popper and Hawkins 2018; 2019). Therefore, these species must be able to detect components of marine soundscapes, and this detectability could be adversely affected by the addition of noise from anthropogenic activity.

5.1.1.2 Effects of Noise from Met and PAM Buoy Installation Vessel Activities

The maximum case scenario will involve the placement of two met buoys and four PAM Buoys within each of the 15 WEA lease areas (30 met buoys and 60 PAM buoys per lease site). As described in **Section 2.2**, the only site assessment activities which would produce noise that could have potential adverse effects on fish, invertebrates, and the EFH of managed species are vessel transits. Vessel transits related to the installation of 30 met buoys (2 buoys per lease) would involve a total of 60 vessel round trips; 60 vessel round trips are also expected for the decommissioning phase. Vessel round trips for quarterly maintenance visits over the course of 5 years are expected to total 300; 900 vessel round trips are expected if maintenance is performed monthly (over 5 years).

Vessel traffic and resultant noise-related impacts are not generally attributed as a compounding factor for noise impacts on the EFH of managed species. The cavitation of vessel propellors produces low-frequency, nearly continuous sound that is audible by most fishes and invertebrates and could mask important auditory cues, including conspecific communication (Haver et al. 2021; Parsons et al. 2021). Stanley et al. (2017) demonstrated that the communication range of both haddock and cod (species with swim bladders but lacking connections to the ear) would be significantly reduced in the presence of vessel noise, which is frequent in their habitat in Cape Cod Bay. Species that are sensitive to acoustic pressure would experience masking at greater distances than those only sensitive to particle motion. Rogers et al. (2021) and Stanley et al. (2017) theorize that fish may be able to use the directional nature of particle motion to extract meaning from short-range cues (e.g., other fish vocalizations) even in the presence of distant noise from vessels.

Avoidance of vessels and vessel noise has been observed in several pelagic, schooling fishes, including Atlantic herring (Vabø et al. 2002), Atlantic cod (Handegard 2003) and others (De Robertis and Handegard 2013). Fish may dive toward the seafloor, move horizontally out of the vessel's path, or disperse from their school (De Robertis and Handegard 2013). These types of changes in schooling behavior could render individual fish more vulnerable to predation but are unlikely to have population-level effects. A body of recent work has documented other, more subtle behaviors in response to vessel noise, but has focused solely on tropical reef-dwelling fish. For example, damselfish antipredator responses (Ferrari et al. 2018; Simpson et al. 2016) and boldness (Holmes et al. 2017) seem to decrease in the presence of vessel noise, while nest-guarding behaviors seem to increase (Nedelec et al. 2017). There is some evidence of habituation, though: Nedelec et al. (2016) found that domino damselfish (*Dascyllus trimaculatus*) increased hiding and ventilation rates after two days of vessel sound playbacks, but responses diminished after one to two weeks, indicating habituation over longer durations. These changes in schooling behavior could render individual fish more vulnerable to predation but are unlikely to have population-level effects.

The limited research on invertebrates' response to vessel noise has yielded inconsistent findings thus far. Some crustaceans seem to increase oxygen consumption (Wale et al. 2013) or show increases in some hemolymph (an invertebrate analog to blood) biomarkers like glucose and heat-shock proteins, which are indicators of stress (Filiciotto et al. 2014). Other species (American lobsters and blue crabs [*Callinectes sapidus]*) showed no difference in hemolymph parameters but spent less time handling food, defending food, and initiating fights with competitors (Hudson et al. 2022). While there does seem to be some evidence that certain behaviors and stress biomarkers in invertebrates could be negatively affected by vessel noise, it is difficult to draw conclusions from this work since it is limited to the laboratory, and in most cases, particle motion was not measured as the relevant cue.

The planktonic larvae of fishes and invertebrates may experience acoustic masking from continuous sound sources like vessels. Several studies have shown that larvae are sensitive to acoustic cues and may use these signals to navigate towards suitable settlement habitat (Montgomery 2006; Simpson et al. 2005), metamorphosize into their juvenile forms (Stanley et al. 2012), or even to maintain group cohesion during their pelagic journey (Staaterman et al. 2014). However, given the short range of such biologically relevant signals for particle motion-sensitive animals (Kaplan and Mooney 2016), the spatial scale at which these cues are relevant is rather small. If vessel transit areas overlap with settlement habitat, it is possible that vessel noise could mask some biologically relevant sounds (Holles et al. 2013), but these effects are expected to be short term and would occur over a small spatial area.

Simply due to the physical nature of vessel noise, it is unlikely to cause barotrauma or auditory damage in fishes, but could lead to behavioral changes, increased stress, or masking. However, as discussed above, species that are sensitive to sound pressure in addition to particle motion will face a higher risk of behavioral disturbance or masking compared to species who are only sensitive to particle motion. Overall, adverse impacts of vessel noise on fish prey species within EFH are expected to be **indirect** and very **short term**, as vessels noise will be transient and localized in nature as the vessels transit through the marine habitat. Only a few individuals would be affected at any given time, and they are likely to return to normal behaviors after the vessel has passed through the zone of influence for hearing and particle motion sensing capabilities of a managed species EFH.

5.1.2 Lighting

Light can attract managed species of finfish and invertebrates, potentially affecting distributions in a highly localized area. Light can also disrupt natural cycles such as spawning. Activities related to the operations supporting met and PAM buoy deployment, operations, maintenance, and decommissioning/removal would result in additional light from vessels and the met buoy navigation lights. Downward-directed deck lighting would have a much greater effect than the navigational lights required on vessels or met buoy. Vessels would be lit during construction, operations, maintenance and decommissioning and would follow USCG and BOEM lighting guidelines. The adverse effects of lighting from these assessment activities would likely be **indirect, long term,** and **mostly unmeasurable.** The levels of light transmitted by vessels during met buoy installation, maintenance, and removal operations would potentially generate low levels of **indirect, short term,** adverse effects, and would cease once installation activities are complete and no synergistic or cumulative effects would occur.

5.1.3 Seafloor Degradation

The maximum case scenario will involve the placement of two met buoys and four PAM Buoys within each of the 15 lease areas totaling 30 met buoy and 60 PAM buoys within the WEA. ADCP sensor packages are proposed to be installed within 500 ft (152 meters) of a met buoy. A wire will be installed connecting the ADCP sensor package to the met ocean buoy. Impacts related to installing this 500 ft cable if any to the EFH of managed species, would not be measurable or detectable and therefore not further considered. The met buoy and PAM buoy systems will be towed or carried aboard a service vessel to the installation location within each WEA Lease. Once in position the buoys would be lowered to the seafloor from the deck of the vessel or placed over the final location where the mooring anchor is lowered (BOEM 2012). The anchor for the met buoy is estimated to weigh about 1,234.2 to 2,057.5 pounds (2,721 to 4,536 kilograms) and is not expected to exceed a footprint of 5.4 square feet (0.5 square meters) with 8.5 acres (34,398 square meters) of disturbance related to anchor chain sweep scour per buoy. The total areal impact within each WEA lease would be 17 acres (68,796 square meters) for two discus- or boat-shaped buoys. The total impact area for all 30 met buoy sites would be approximately 255 acres (1 square kilometer). If a spar-type met buoy is used, the maximum area of disturbance is expected to be 1,270 square feet (118 square meters) per buoy (38,100 square feet [3,540 square meters] for all 30 buoys). PAM Buoy systems are much smaller in size and the anchoring systems would result in much smaller impact areas. The scour impact caused by a single met or PAM buoy system would occur during the 5-year residence of the buoys within each Lease Area. The scour impacts would occur within a staggered deployment and operation time frame of over a 5-year period.

The types of impacts likely to occur would result in burial from displaced seabed sediments or crushing impacts on infauna and habitat loss or conversion to an artificial reef substrate (anchor) attracting demersal finfish and invertebrate species. Deployment and removal of the met buoy may also cause a punctuated initial increase in local suspended sediments; however, these impacts would be limited to very small area and would be short term in duration. The adverse effects related to the anchor chain sweep would not be as severe as the crushing and potential mortality that could occur within the footprint of the buoy anchor. However, the anchor chain sweep would be repeated throughout the buoy deployment as the anchor chain moves relative to the current regimen and wind direction. The loss and conversion of the softbottom sand habitat would impact the sensitive life stages of demersal eggs, larvae, and adult life stages of invertebrate managed sessile and mobile softbottom benthic species such as Atlantic sea scallop, longfin inshore squid, ocean quahog, and deep-sea red crab. Managed finfish species that could be affected are Atlantic herring, Acadian redfish, monkfish, ocean pout, hakes (red hake, silver hake, white hake), scup, sharks (sand tiger shark, sandbar shark, spiny dogfish), skates (barndoor skate, little skate, rosette skate, smooth skate, thorny skate, winter skate) and flatfish (American plaice, summer flounder, winter flounder, windowpane flounder, witch flounder, yellowtail flounder). The impact related to anchor installation and presence during the 5-year operation of the met buoy systems would be temporary and the seafloor impacted could potentially return to pre-existing conditions without mitigation once the met buoy and anchoring system is removed (Dernie et al. 2003). Met and PAM Buoy positions will be selected using the geophysical data collected during the initial assessment as a preclearance to avoid sensitive habitats as much as practically possible. Adverse effects related to seafloor disturbance would be **direct but minimal** since the seafloor area impacted is very small and localized (in comparison to the 2.0 million acre [8,093.7 square kilometers] area of the WEA). The adverse effects to the EFH of managed finfish and invertebrate species however would be considered temporally **long term** but would return to pre-existing conditions within a few months to a year once the buoy and anchor systems are removed. No synergistic or cumulative consequences are predicted to occur relative to the installation and operation of the met buoy systems.

5.1.4 Entanglement

Entanglement related to site assessment would be associated with an EFH species being wrapped, intertwined, or ensnared with the anchor-line or tackle of the met or PAM buoy anchor systems. This type of interaction would most likely occur during the initial anchor deployment or during a slack current or tidal ebb event. The potential for this risk is very low but not impossible. The risk for entanglement with an anchor line supporting the met and PAM buoy anchor systems is directed on marine megafauna such as whales, larger sea turtles, and potentially basking sharks. The potential for a basking shark to become entangled in the met or PAM buoy anchor lines is conceivable but very unlikely and would not result in a population-level effect. The potential for entanglement would result in a **long term direct adverse impact** but with an extremely low probability of occurrence. An entanglement impact if it were to occur for the basking shark would be an **adverse impact** and likely would result in a **mortality event** for that individual and the adverse effect would be nonexistent for the EFH of managed species within the Project area.

5.1.5 Routine Vessel Discharges

Vessels to be utilized for the site assessment activities are required 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 U.S. Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) Vessel General Permit standards, both of which aim to prevent the release of contaminated water discharges. Vessel transits related to the installation of 30 met buoys (2 buoys per lease) would involve a total of 60 vessel round trips; 60 vessel round trips are also expected for the decommissioning phase. Vessel round trips for quarterly maintenance visits over the course of 5 years are expected to total 300; 900 vessel round trips are expected if maintenance is performed monthly (over 5 years). Vessel trips would additionally be increased by an extra 420 round trips through the installation, maintenance, and decommissioning of the PAM buoy systems. These vessel trips will increase the routine vessel discharges within the GAA but are not expected to create a measurable cumulative or synergistic adverse effect. Routine releases from assessment activities would not be expected to contribute appreciably to the adverse effects on the EFH of managed species; adverse impacts related to the release of contaminated discharges or invasive species on EFH resources are considered **indirect** and **short term** if not unmeasurable within the GAA.

5.1.6 Vessel Traffic and Space-use Conflicts

The main stressor related to vessel traffic and space-use conflicts for the EFH of managed species will be the presence and noise related to vessel traffic. The presence and noise produced by the vessels to be utilized during the site assessment will be short in duration. The increase in vessel traffic is expected to be **indirect** and **short term** if not unmeasurable on the EFH of the managed species within the WEA and proposed export cable routes.

5.2 Site Characterization Activities

5.2.1 Noise

As described in **Section 2.2**, the site characterization activities which would produce noise that could have potential adverse effects on fish, invertebrates, and EFH include the vessel transits, biological and geotechnical, and HRG surveys.

5.2.1.1 Effects of Noise from Site Characterization Vessel Activities

Based on the available information for the proposed site characterization activities, it is estimated that up to 851 vessel trips associated with HRG surveys will occur in addition to 49 vessel round trips associated with geotechnical and benthic sampling. 1,920 vessel days are expected to occur for biological/oceanographic sampling surveys, and 540 vessel-based surveys are expected for marine mammal, sea turtle and avian surveys. While the volume of vessel traffic differs from that described for the site assessment vessel activities in **Section 2.2**, the noise levels produced and potential effects on fish, invertebrates, and EFH would be expected to be the same as described in **Section 5.1.1**. The proposed vessel trips would occur over an approximate 3-year period. Given the non-impulsive nature of this noise source, no injury is likely to occur for any species and the range over which behavioral distances may occur for both sound pressure and particle motion is expected to be relatively small. Additionally, as the vessels would be transiting while in the Project area, animals in proximity to the source would only be exposed for a relatively short duration and would be expected to return to normal behaviors once the vessel has moved out of range. Overall, the adverse effects of vessel noise on fish prey species within EFH are expected to be **indirect and short term**, as they will be transient and localized in nature. Only a few individuals would be affected at any given time, and they are likely to return to normal behaviors after the vessel has passed through the zone of influence for hearing and particle motion sensing capabilities of the finfish and invertebrate managed species.

5.2.1.2 Effects of Noise from Site Characterization Geotechnical Activities

As described in **Section 2.2**, geotechnical surveys for site characterization include the use of piston or vibracores, deep borings, and cone penetration testing which may produce noise at levels which exceed the behavioral disturbance threshold for fishes. Data measured during use of a pneumatic vibracore indicated that this is a non-impulsive, intermittent source with the greatest noise levels at frequencies below 3 kilohertz and a back-calculated source level, expressed as SPL, estimated to be 187 dB re 1 μPa m (Chorney et al. 2011). Simply due to the physical nature of geotechnical equipment noise, it is unlikely to cause barotrauma or auditory damage in fishes, but the estimated source level is above the behavioral disturbance threshold of 150 dB re 1 μPa for fish recommended by the Fisheries Hydroacoustic Working Group (2008) and NMFS (2023), so it could lead to behavioral changes, increased stress, or masking. However, geotechnical surveys would only occur seasonally within each WEA lease area (**Section 2.2**). The geotechnical surveys are relatively short in duration, consist of a small number of samples that are widely geographically spaced which lowers the risk of stressor effects on behaviors relevant for foraging or spawning and would not be likely to lead to any long-term masking in EFH habitat. Overall, adverse effects of geotechnical survey noise on fish prey species within EFH are expected to be **indirect** and

short term, as they will be transient and localized in nature with no synergistic or cumulative consequences on the managed species or their EFH. Only a few, if any, individuals would be adversely affected at any given instance, and they are likely to return to normal behaviors after the geotechnical surveys have been completed.

5.2.1.3 Effects of Noise from Site Characterization Geophysical Activities

The proposed geophysical survey site characterization survey activities include the use of HRG equipment such as CHIRPs, boomers, sparkers, parametric sub-bottom profilers, side-scan sonar, and USBL positioning systems as provided in Table 2-5 of the EA. As discussed in **Section 5.1.1.2**, the broadest range of frequency sensitivity is seen in fish that are able to detect sound pressure (i.e., fish with swim bladders) and their hearing sensitivity only extends up to 3 kilohertz. Therefore, of the sources that may be used during HRG surveys under the Proposed Action, only the CHIRP, boomer, and sparker equipment may emit sounds at frequencies that are within the hearing range of most fish (Crocker and Fratantonio 2016; Ruppel et al. 2022). However, though this source is audible for some fishes, it is important to consider other factors such as source level, beamwidth, and duty cycle when assessing the potential risk of adverse effects (Ruppel et al. 2022). Estimated source levels for these equipment are summarized in Table 2-5 of the EA. Use of AUVs may be part of the HRG survey activities and specifics of those devices and how they will be used will be survey specific. However, potential effects from HRG equipment deployed using AUVs would be the same as or less than those described for vessel-based HRG surveys discussed here, which is consistent with the 2021 informal programmatic Biological Assessment for Data Collection and Site Survey Activities for Renewable Energy on the Atlantic Outer Continental Shelf (Baker and Howson 2021) that determined geophysical instrumentation deployed from AUVs is unlikely to result in adverse effects on any marine species.

Behavioral impacts could occur over slightly larger spatial scales. For example, using the SPL threshold of 150 dB re 1 µPa for behavioral disturbance (Fisheries Hydroacoustic Working Group 2008; NMFS 2023) and spherical spreading loss, the range to this threshold would extend to approximately (1,030 feet (314 meters) for boomer equipment; 5,135 feet (1,565 meters) for sparker equipment; and 203 feet (62 meters) for CHIRP equipment. However, this threshold does not account for the duration of the exposure, and it is worth noting that these numbers are reported in terms of acoustic pressure because there are currently no behavioral disturbance thresholds for particle motion. Additionally, given the limited duration of these surveys and because HRG equipment are considered intermittent sources, where they are typically “on” for short periods with silence in between, the amount of noise emitted from a moving vessel towing an active acoustic source that would reach fish or invertebrates below is limited, behavioral effects would be intermittent and temporary. Should an exposure occur, the potential effects would be brief, and no long-term avoidance of the Project area or effects on reproduction are expected. Effects of this brief exposure could result temporary disruptions to foraging behavior; however, if exposures were to occur, they would not be expected to result in long-term effects on any species or EFH. Overall, adverse effects of HRG survey noise on finfish, invertebrates and their prey species within the EFH of managed species are expected to be **indirect** and **short term**, as they will be transient and localized in nature. The sound emitted from the HRG survey equipment will cease immediately after the survey is complete and no synergistic or cumulative consequences will occur within the WEA and proposed export cable routes. Only a few individuals would be affected at any given time, and they are likely to return to normal behaviors after the HRG surveys have been completed.

Noise related to the geotechnical sampling methods vibracoring, deep borings, and CPT will be utilized to obtain samples of sediments at each potential turbine location and along the cable route. For most of these methods, noise source levels have not been directly measured, available data for vibracores indicate this equipment will produce low-frequency (<3 kHz), non-impulsive noise with a back-calculated SPL source level of 187.4 dB re 1 µPa m (Chorney et al. 2011), and it is generally assumed that low-frequency, low-level noise will be introduced as a byproduct of all other activities given the nature of the equipment

(BOEM 2023b). It is likely that the sound of the vessel will exceed that generated by the geotechnical method itself. Because of the noise of the geotechnical equipment is considered to be masked by the supporting vessel noise, the adverse effects to the managed species in the GoMe would be **direct** and short term and not expected to create a measurable cumulative or synergistic adverse effect.

5.2.2 Lighting

Activities related to the site characterization operations would result in additional light from support vessels during the 24-hour operations. The survey vessels would be lit during the nocturnal period of the survey operations and would follow USCG and BOEM lighting guidelines. As summarized in **Section 5.1.2**, the adverse effects related to lighting from vessels supporting site characterization operations would be **indirect, short term,** and transitory in nature to EFH of managed species within and immediately contiguous with the proposed WEA and proposed export cable routes. The lighting from the survey vessels is not expected to create a measurable cumulative or synergistic adverse effect.

5.2.3 Seafloor Degradation

Biological and geotechnical surveys within the WEA and export cable routes will require varying levels of benthic seafloor disturbance to collect samples and the data to characterize the benthic biological and geological existing conditions within the WEA and export cable routes. Biological sampling methods expected to disrupt the seafloor include benthic grabs (e.g., Hamon grab, Van Veen) and sediment profile imagery (SPI). Geotechnical sampling methods expected to disrupt the seafloor include vibracoring, CPT and/or deep borings.

Benthic grab samplers used for assessing infauna assemblages penetrate upper 4 to 6 inches (10 to 15 centimeters) of seafloor sediment for a total disturbance area of 1.1 square feet (0.1 square meters) per sample. The SPI sampling device disturbs a slightly smaller area but does not remove or collect any sediment. The SPI frame and camera prism does impact a larger footprint (approximately 43 square feet [4 square meters]) per image sampling site but no organisms are removed from the site and the SPI camera and frame is only in contact with the seafloor for less than 3 to 10 minutes during image collection per sample site. A similar level of disturbance is to be expected from sampling within the export transmission cable routes. Benthic video transects will be collected near benthic infaunal grabs. The video transects are 50 m (164 feet) in length. Benthic sleds are designed to be towed under power of the vessel and glide above the the sediment surface with generally only accidental contact with the sediment habitat. Since the contact with the seafloor is extremely short in duration and there is minimal disturbance of the seafloor the impacts related to this survey method was not added to the seafloor degradation surficial estimates. Geotechnical sampling will include the collection of vibracore samples (expected area of seafloor disturbance per sample is 3 square meters [32.3 square feet]), CPT (expected area of seafloor disturbance per sample is 4 square meters [43.1 square feet]). Geotechnical and benthic sampling of the WEA is expected to result in three samples at every potential wind turbine location, representing the likely scenario of three anchor legs each with one line, which would only occur in the portion of the WEA where structural placement of floating turbine anchors is allowed. Geotechnical sampling within the WEA will require 3,645 samples and benthic sampling will require 3,735 samples. Geotechnical and benthic sampling within offshore export cable corridor is expected to be collected at a rate of one sample per kilometer totaling 6149 and 6149, respectively. The total number of geotechnical and benthic samples to be collected within the WEA and cable corridor is estimated to be 19,678.

It is assumed that approximately 50 percent of deployments for geotechnical sampling work could involve vessel anchoring, resulting in an estimated impact of up to 108 square feet (10 square meters) per geotechnical station. Based on the assumptions discussed above, a maximum impact of 108 square feet (10 square meters) is estimated for 50 percent of the samples, while 43 square feet (4 square meters) is estimated for the remaining 50% of the samples. Based on these assumptions, the total expected benthic impact from anchoring during geotechnical sampling is 1,184,030 square feet (110,000 square meters).

These spatially small, disturbed surface areas may temporarily displace bottom feeding demersal EFH finfish or squids (longfin inshore or northern shortfin squid) and may remove or injure individual Atlantic sea scallops. These samples may also remove or injure demersal eggs, such as those deposited by winter flounder, longfin inshore squid, wolffish, or the egg cases deposited by various skate species. Infauna and epifauna that contribute to the prey base for demersal species such as hakes and skates may be adversely affected by bottom sampling. WTG and cable corridor benthic sampling station will be selected using the geophysical data collected during the initial assessment activities as a preclearance to avoid sensitive habitats as much as practically possible. While the biological sampling will result in some benthic disturbance and direct mortality of soft bottom assemblages, the dispersed geographical nature of this activity over the WEA and the connected cable corridors will have a limited if not unmeasurable **direct, short term** adverse effect on the benthic resources and Sessile and Mobile Benthic Softbottom and Complex Habitat EFH of managed species that utilize this habitat. The impacts related to biological sampling will not proliferate into synergistic or cumulative consequences within the proposed WEA and export cable routes environments.

5.2.4 Routine Vessel Discharges

Vessels to be utilized for the site characterization activities are required 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 NPDES Vessel General Permit standards, both of which aim to prevent the release of contaminated water discharges. Vessel operations related to the site characterization activities will only increase to an extra 49 trips over a multi-year campaign which will slightly increase the routine vessel discharges within the WEA and along export cable routes. As such, routine releases from characterization activities related to the project area would not be expected to contribute appreciably to overall adverse effects on the EFH of managed species; adverse effects related to the release of contaminated discharges or invasive species on the EFH resources are considered **indirect** and very **short term** if not unmeasurable within the GAA and not expected to cause synergistic or cumulative adverse effects.

5.2.5 Vessel Traffic and Space-use Conflicts

The main stressor related to vessel traffic and space-use conflicts for the EFH of managed species will be the presence and noise related to survey vessel traffic. The presence and noise produced by the vessels to be utilized during the site characterization will be short in duration. These activities will be separate punctuated cruises transiting to and from port facilities over a 2-year period. The increase in vessel traffic is expected to be a **direct, but very short term** if not unmeasurable adverse effect and not expected to cause a synergistic or cumulative impact on the EFH of managed species within the WEA and proposed export cable routes.

5.3 Non-routine Events

5.3.1 Storms

As presented in **Section 2.3.1,** major storms like nor'easters and subtropical hurricanes have the potential to negatively impact the met buoys and the operations and scheduling of the survey vessels. Met buoy components are designed to withstand these extreme conditions. Though unlikely, structural failure of a met buoy could result in a temporary hazard to navigation or impacts to benthic resources if the met buoy were to flounder and sink. Storms could contribute to an increased likelihood of allisions between vessels and met buoys and collisions between vessels that could result in a spill. However, the storm would cause the spill and its effects to dissipate faster than under calm conditions, vessel traffic is likely to be significantly reduced in the event of an impending storm, and surveys related to the Proposed Action would be postponed until after the storm has passed. If either of these scenarios were to occur the adverse effects related to a failure in the met buoy systems would be a **direct, short-term** adverse effect to the EFH of the managed species within the research lease, and export cable routing and wider GAA.

5.3.2 Allisions and Collisions

Collisions between vessels and allisions between vessels and met buoys are considered unlikely because vessel traffic is controlled by multiple routing measures, such as safety fairways, traffic separation schemes, and anchorages. These higher traffic areas were excluded from the WEA. The risk of allisions with met buoys and survey vessels would be further reduced by USCG-required marking and lighting. If either of these scenarios (an allision or collision) were to occur the adverse effects related to these occurrences would be **direct** and **short term** to the demersal EFH of the managed species within the WEA, export cable routing and wider GAA.

5.3.3 Spills

Accidental releases may increase as a result of offshore survey activities. As discussed in the Gulf of Maine EA (Section 3.2.3, Water Quality), releases could expose coastal and offshore waters to contaminants in the event of a spill or release during routine vessel use, collisions and allisions. The risk of any type of accidental release would be increased primarily during survey operations. These vessels are required 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 USEPA NPDES Vessel General Permit standards, both of which aim to prevent the release of ballast waters contaminated with an invasive species. Implementation of these waste management and mitigation measures, as well as marine debris awareness training, would reduce the likelihood of an accidental release. As such, accidental releases related to the characterization survey operations would not be expected to contribute appreciably to overall impacts on the EFH of managed species; adverse effects related to an accidental spill on EFH resources or managed species would be very limited in volume and considered to be **indirect** and very **short term**.

5.3.4 Recovery of Lost Survey Equipment

Recovery of lost sampling gear could involve the loss of survey equipment, or sampling gear for the biological surveys such as benthic grabs, video sleds or geophysical survey equipment lost during the proposed survey activities listed in **Table 2-1**. It is important to recover the equipment as soon as possible to reduce the potential of causing added negative impacts to the environment through entanglement of organisms or damage to sensitive habitats (eelgrass beds, mussel beds, or hard bottom habitats) within the WEA or export cable corridors. Recovery methods may entail using small remotely operated vehicles or dragging grapnel lines depending on the sensitivity of the equipment, the sensitivity of the habitat in which the equipment was lost, and the need to recover the equipment in an intact and undamaged condition. If during survey operations a piece of biological sampling equipment is lost, and accurate coordinates are recorded the potential for utilizing a remotely operated vehicle may be applicable for recovery. This methodology for equipment recovery would result in the least number of adverse effects to the environment. Such recovery efforts are expected to occur infrequently and are expected to have **direct,** very **short-term** adverse effects to the demersal EFH of the managed species or life stages if this type of equipment recovery is required.

5.4 Effects Summary

Table 5-1 provides an effects analysis roadmap by providing the summary of project activities, sources of adverse effects, and references to the section of the EFH assessment where the effects of project activities are analyzed.

Table 5-1. EFH effects analysis roadmap by project phase, activity, source, and duration

Survey or Monitoring Activity	Activity	Sources	Duration	Analysis Sections
Site Assessment	Met Buoy Installation, Maintenance, and Decommissioning	• Noise (vessel noise) • Lighting • Seafloor Degradation • Entanglement • Routine Vessel Discharges • Vessel Traffic and Space-use Conflicts	• Short term • Long term • Long term • Long term • Short term • Short term	• 5.1.1.2 • 5.1.2 • 5.1.3 • 5.1.4 • 5.1.5 • 5.1.6
Site Characterization	High-resolution Geophysical Surveys	• Noise (vessel noise) • Noise • Lighting • Seafloor Degradation • Routine Vessel Discharges • Vessel Traffic and Space-use Conflicts	• Short term • Short term • Short term • Short term • Short term • Short term • Short term	• 5.2.1.1 • 5.2.1.3 • 5.2.2 • 5.2.3 • 5.2.4 • 5.2.5
Site Characterization	Geotechnical Surveys and Seafloor Sampling	• Noise (vessel noise) • Noise • Lighting • Seafloor Degradation • Routine Vessel Discharges • Vessel Traffic and Space-use Conflicts	• Short term • Short term • Short term • Short term • Short term • Short term	• 5.2.1.1 • 5.2.1.2 • 5.2.2 • 5.2.3 • 5.2.4 • 5.2.5
Site Characterization	Biological Surveys	• Noise (vessel noise) • Lighting • Seafloor Degradation • Routine Vessel Discharges • Vessel Traffic and Space-use Conflicts	• Short term • Short term • Short term • Short term • Short term	• 5.2.1.1 • 5.2.2 • 5.2.3 • 5.2.4 • 5.2.5

6 Avoidance, Minimization, and Mitigation

6.1 Standard Operating Conditions

SOCs for the Proposed Action are described in Appendix H of the EA. BOEM's primary mitigation strategy has and will continue to be avoidance. For example, the exact location of the met buoy would be adjusted to avoid adverse effects to biologically sensitive habitats, if present. Overall adverse impacts to finfish and invertebrates from biological surveys are anticipated to be **direct** and very **short term** to the demersal EFH of the managed species.

A condition of the proposed lease is the requirement to conduct appropriate consultation with NMFS and BOEM prior to carrying out any fisheries surveys.

6.2 Mitigation and Environmental Monitoring

The avoidance, minimization, and mitigation measures proposed to be utilized during the site assessment and site characterization activities are outlined in the PDCs, and BMPs for Protected Species Associated with Offshore Wind Data Collection document (BOEM 2021); those that reduce impacts to EFH are included in **Appendix B**. While the PDCs and BMPs were designed under consultation with NMFS which resulted in a Letter of Concurrence under Section 7 of the ESA, many of the PDCs and BMPs would reduce impacts to EFH resources and protected marine habitats. The PDCs and BMPs pertain to site characterization (HRG, geotechnical, and biological surveys) and site assessment/data collection (deployment, operation, and retrieval of meteorological and oceanographic data buoys) activities associated with Atlantic OCS leases (BOEM 2021). BOEM will implement the measures outlined in the document to avoid, minimize, and mitigate the potential effects of routine activities associated with assessment activities on the lease and site characterization activities within the project area. **Appendix B** provides a summary of the avoidance, minimization, and mitigation measures for this proposed action.

6.3 Alternative Project Designs that Could Avoid/Minimize Impacts

No project alternatives have been proposed or designed for the WEA or associated potential project easements. The only alternative proposed for this commercial lease is the No Action Alternative. Under the No Action Alternative, BOEM would not issue a wind energy commercial lease or associated potential project easements to the State of Maine. No site assessment or site characterization activities requiring BOEM approval would be conducted. Although some site characterization surveys that are conducted on unleased or ungranted areas of the OCS do not require BOEM approval and could still be conducted under the No Action Alternative, these activities are less likely to occur without a commercial lease.

6.4 Adaptive Management Plans

BOEM has not prepared or proposed an Adaptive Management Plan to offset potential impacts related to the WEA or associated export cable routes.

7 NOAA Trust Resources

This section includes a discussion on the finfish, shellfish, crustaceans, or their habitats, that are not managed under a federal FMP. Some of the NOAA Trust species, including diadromous fishes, serve as prey for a number of federally managed species and are therefore considered a component of EFH pursuant to the MSA. Nineteen species of NOAA Trust Resources have been identified within the general vicinity of the WEA and export cable routes. **Appendix A** provides information representing the species and life stages within the WEA and export cable routes. The adverse effects as outlined in **Section 5** concerning the site assessment and site characterization as well as the impact determination will be much the same as the impacts for the NOAA Trust species and result in **direct** and **indirect** adverse impacts with short-term temporal effects.

8 Conclusions/Determination(s)

Fifty-eight (58) species of finfish (34), elasmobranchs (19), and invertebrates (5) were identified with designated EFH within the GAA. The life stages and EFH-designated species are discussed in **Section 4**. The scope of the project site assessment and characterization is described in **Section 2**, would result in some short- and long-term adverse effects on the EFH species listed in **Appendix A**. Analyses of Project activities on EFH are analyzed in **Section 5**. Impacts associated with site assessment and characterization are deemed to result in spatially discrete and short term and some long-term adverse effects. The main source of adverse effects will be seafloor disturbance due to the installation of the met buoy anchor systems. No permanent impacts are related to the installation of the anchor system since the buoy and anchors are to be removed after a 4-to-5-year deployment. Therefore, BOEM expects the overall adverse effects on the EFH of finfish and invertebrate managed species would be **direct** and **indirect** and with mainly **short term** and some spatially discrete long term benthic adverse effects due to the length of the deployment for the met buoys within the WEA. BOEM would be mandating the application of PDCs and BMPs outlined in **Appendix B** set forth by BOEM and NMFS under in a Letter of Concurrence under Section 7 consultation which should further reduce impacts (but would most likely not change the impact determinations).

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Appendix A EFH-designated species within the Gulf of Maine Wind Energy GAA

Table A-1. EFH-designated species within the Gulf of Maine Wind Energy GAA

Species	Eggs					Larvae/ Neonates					Juveniles					Adults					HAPC	EFH Description
	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank		
Acadian redfish (*Sebastes fasciatus*)	– –	– –	– –	– –	– –	●	●	●	– –	●	●	●	●	– –	●	●	●	●	●	●	– –	**General habitat description**: EFH for each life history stage is found in the GoME, on the southern portion of Georges Bank, and outside of the GoME along the continental slope to a maximum depth of 600 meters depth north of the Delaware Bay Latitude (NEFMC 2017). c Pelagic habitats in the GoME, on the southern portion of Georges Bank (NEFMC 2017). Juveniles: Sub-tidal coastal and offshore benthic habitats in the GoME between 50–200 meters (NEFMC 2017). EFH for juveniles consists of seafloor habitats of complex rocky reef substrates with structure-forming epifauna (e.g., sponges, corals), and soft sediments with cerianthid anemones (NEFMC 2017). Young-of-the-year juveniles are found on boulder reefs, while older juveniles are found in dense cerianthid habitats. Juveniles do not use unstructured mud habitat and prefer mainly hard bottom in the deep basins (NEFMC 2017). **Adults**: Offshore benthic habitats in the GoME, primarily in depths between 140–300 meters. EFH for adult redfish occurs on finer grained bottom sediments and variable deposits of clays, silts, gravel, and boulders with associated structure- forming epifauna (e.g.– –corals, sponges, cerianthid anemones, sea pens [NEFMC 2017]).
Atlantic albacore tuna (*Thunnus alalunga*)	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	●	●	●	– –	●	●	– –	●	– –	●	– –	**General habitat description**: Juveniles migrate to northeastern Atlantic waters in the summer for feeding. Adults are commonly found in northern Atlantic waters in September and October for feeding. Juveniles: EFH for juvenile albacore tuna is designated as pelagic offshore waters of the U.S. Atlantic east coast from Cape Cod to Cape Hatteras (NOAA Fisheries 2017). **Adults**: Offshore, pelagic habitats of the Atlantic ocean from the outer edge of the U.S. EEZ through Georges Bank to pelagic habitats south of Cape Cod, and from Cape Cod to Cape Hatteras, North Carolina. EFH also includes offshore pelagic habitats near the outer U.S. EEZ between North Carolina and Florida, and offshore pelagic habitats associated with the Blake Plateau. EFH also includes offshore pelagic habitats in the western and central Gulf of Mexico (NOAA Fisheries 2017).

Species	Eggs					Larvae/ Neonates					Juveniles					Adults					HAPC	EFH Description
	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank		
American Plaice (Hippoglossoides platessoides)	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: EFH for each life history stage is found in the GoME including the high salinity zones (salinity >25.0 ppt) of the bays and estuaries within the GoME (NEFMC 2017). **Eggs**: Pelagic habitats GoME and on Georges Bank (NEFMC 2017). **Larvae**: Pelagic habitats in the GoME, on Georges Bank, and in southern New England including bays and estuaries (NEFMC 2017). Juveniles: Sub-tidal benthic habitats in the GoME and the western portion of Georges Bank, between 40–180 meters including bays and estuaries (NEFMC 2017). EFH for juvenile American plaice consists of soft bottom substrates (mud and sand), but they are also found on gravel and sandy substrates bordering bedrock (NEFMC 2017). **Adults**: Sub-tidal benthic habitats in the GoME and the western portion of Georges Bank, between 40–300 meters and including coastal bays and estuaries (NEFMC 2017). EFH for adult American plaice consists of soft bottom substrates (mud and sand), but they are also found on gravel and sandy substrates bordering bedrock (NEFMC 2017).
Atlantic bluefin tuna (*Thunnus thynnus*)	– –	– –	– –	– –	●	– –	– –	– –	– –	– –	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: Bluefin tuna inhabit northeastern waters to feed and move south to spawning grounds in the spring. Bluefin tuna is considered a Species of Concern because they support important recreation and commercial fisheries, and population size is unknown (NOAA Fisheries 2017). **Spawning, eggs, and larvae**: This life stage has been expanded into two areas of the Slope Sea (between North Carolina and Georges Bank, north of the Gulf Stream) due to the presence of extremely young larvae. One area encompasses pelagic habitats on and off the continental shelf, off the coast of North Carolina, and extends to the shoreline between the NC/VA line and Oregon Inlet. The other area includes pelagic waters of the Slope Sea, extending to the outer United States' EEZ south of Georges Bank. EFH for larvae is defined by habitat associations with temperatures ranging from 23.5 to 28 °C. **Juveniles**: EFH for juvenile bluefin tuna is designated as continental shelf waters off Cape Cod to Cape Hatteras within an area of the slope sea (NOAA Fisheries 2017). **Adults**: EFH for adult bluefin tuna is pelagic waters from the mid-coast of Maine to the Mid-Atlantic (NOAA Fisheries 2017).

Species	Eggs					Larvae/ Neonates					Juveniles					Adults					HAPC	EFH Description
	Cable Area	WEA	Western-Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western-Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western-Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western-Central GoME	Scotian Shelf-Eastern GoME	Georges Bank		
Atlantic butterfish (*Peprilus triacanthus*)	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: Butterfish are found within the GoME throughout the year and are present in nearshore areas in the fall, and therefore may be impacted by cable installation (MAFMC and NOAA Fisheries 2011). **Eggs**: EFH is designated for butterfish eggs in pelagic habitats with depths under 1,500– –meters and average temperatures between 9 and 22°C in inshore estuaries and embayments from Massachusetts Bay to Chesapeake Bay, and in patches on the continental shelf/slope from Maine southward to Cape Hatteras, North Carolina (MAFMC and NOAA Fisheries 2011). **Larvae**: EFH for butterfish larvae is designated as pelagic habitats in inshore estuaries and embayments from Boston Harbor to Chesapeake Bay and over the continental shelf, from the GoME to Cape Hatteras (MAFMC and NOAA Fisheries 2011). **Juveniles**/**Adults**: EFH for juvenile and adult butterfish is pelagic habitats in inshore estuaries and embayments from Massachusetts Bay to Pamlico Sound on the inner and outer continental shelf from the GoME to Cape Hatteras (MAFMC and NOAA Fisheries 2011). EFH for adult Atlantic butterfish is generally found over bottom depths between 10 and 250 meters where bottom water temperatures are between 4.5 and 27.5°C and salinities are above 5 ppt (MAFMC and NOAA Fisheries 2011).

Species	Eggs					Larvae/ Neonates					Juveniles					Adults					HAPC	EFH Description
	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank		
Atlantic cod (*Gadus morhua*)	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: Atlantic Cod EFH includes all coastal habitats that contain structurally complex benthic resources, including eelgrass, mixed sand, and gravel, and rocky habitats (NEFMC 2017). These habitats are particularly important for juvenile Atlantic cod as it provides protection from predation and readily available prey sources (NEFMC 2017). **Eggs**: EFH for Eggs include pelagic habitats in the GoME, on Georges Bank, the Mid-Atlantic region, and in the high salinity zones (salinity (>25 ppt) of the bays and estuaries. Cod spawn primarily in bottom habitats composed of sand, rocks, pebbles, or gravel during fall, winter, and early spring (NOAA 2022). Cod eggs are found in the fall, winter, and spring in water depths less than 110 meters (NEFMC 2017). **Larvae**: EFH for larval cod is pelagic waters (depths of 30 to 70 meters) from the GoME to the Mid-Atlantic and are primarily observed in the spring (Lough 2004). **Juveniles**: Intertidal and sub-tidal benthic habitats in the GoME, southern New England, and on Georges Bank, to a max depth of 120 meters, including high salinity zones in the bays and estuaries within the GoME. Structurally complex habitats, including eelgrass, mixed sand and gravel, and rocky habitats (gravel pavements, cobble, and boulders). In inshore waters, YOY juveniles prefer gravel and cobble habitats and eelgrass beds as refugia, but in the absence of predators also utilize adjacent un-vegetated sandy habitats for feeding (NEFMC 2017). **Adults**: Sub-tidal benthic habitats in the GoME, south of Cape Cod, and on Georges Bank, between 30–160 meters, including high salinity zones in the bays and estuaries (NEFMC 2017). EFH for Adult Cod includes structurally complex hard bottom habitats composed of gravel, cobble, and boulder substrates with and without emergent epifauna and macroalgae. Adult cod are also found on sandy substrates and frequent deeper slopes of ledges along shore (NEFMC 2017).
Atlantic herring (*Clupea harengus*)	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: Larvae are free-floating and generally observed between August and April in areas with water depths from 50–90 meters. Juvenile and adult herring are found in areas with water depths from 20–13 meters. **Eggs**: Herring eggs adhere to the bottom; therefore, EFH is designated as inshore and offshore benthic habitats mainly in the GoME, Georges Bank, and Nantucket Shoals in depths of 5–90 meters on coarse sand, pebbles, cobbles, and boulders and/or macroalgae (NEFMC 2017). **Larvae**: EFH for larval Atlantic herring is pelagic waters in the GoME, Georges Bank, and southern New England (NEFMC 2017). **Juveniles**/**Adults**: EFH for juvenile and adult herring is pelagic and bottom habitats in the GoME, Georges Bank, southern New England, and the Mid-Atlantic region (NEFMC 2017).

Species	Eggs					Larvae/ Neonates					Juveniles					Adults					HAPC	EFH Description
	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank		
Atlantic mackerel (*Scomber scombrus*)	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: Eggs float in the upper 10–15 meters of the water column, while larvae can be found in depths ranging from 10–130 meters (Studholme et al. 1999).The depth preference of juvenile mackerel shifts seasonally as they are generally found higher in the water column (20–50 meters) in the fall and summer, deeper (20–70 meters) in the winter, and widely dispersed (30–90 meters) in the spring (NOAA 2022; Studholme et al. 1999). **Eggs/Larvae**: EFH for mackerel (egg and larval stages) is pelagic habitats in inshore estuaries and embayments from Great Bay to Long Island, inshore and offshore waters of the GoME, and on the continental shelf from Georges Bank to Cape Hatteras (NEFMC 2017). **Juveniles**: EFH for juvenile Atlantic mackerel is designated in pelagic waters with bottom depths of 10–110 meters (NEFMC 2017). **Adults**: EFH for adult mackerel includes pelagic habitats the same region as for juveniles, but in waters with bottom depths <70– –meters (NEFMC 2017).
Atlantic sea scallop (*Placopecten magellanicus*)	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: All life stages have the same EFH spatial designation, which extends across much of the greater Atlantic region. During the larval stage, scallops are free-swimming and occur within the water column and near the seafloor. Hard substrate is particularly important as it provides essential habitat for settling larvae, which were found to have higher survival rates when attaching to hard surfaces rather than shifting sand or macroalgae (NEFMC 2017). **Eggs**: Because sea scallop eggs are heavier than seawater and remain on the seafloor until the larval stage, EFH is designated in benthic habitats in inshore areas and the continental shelf (NEFMC 2017). **Larvae**: EFH for the larval stage (referred to as “spat”) includes benthic and pelagic habitats in inshore and offshore areas throughout the region. Any hard surface can provide an essential habitat for settling pelagic larvae (“spat”), including shells, pebbles, gravel, and macroalgae and other benthic organisms. Spat that settle on shifting sand do not survive (NEFMC 2017). **Juveniles/Adults**: EFH for juvenile and adult sea scallops include sand and gravel substrates in the benthic habitats in depths of 18–110 meters (NEFMC 2017).

Species	Eggs					Larvae/ Neonates					Juveniles					Adults					HAPC	EFH Description
	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank		
Atlantic Wolffish (*Anarhichas lupus*)	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: Atlantic Wolffish EFH extends from waters north of 41°N latitude and east of 71°W longitude in depths of water ranging from 10 meters in the northern portions of the GoME (NEFMC 2017). **Eggs**: EFH for Wolffish eggs is sub-tidal benthic habitats at depths less than 100– –meters. Wolffish egg masses are hidden under rocks and boulders in nests. **Larvae**: Larvae EFH is pelagic and sub-tidal benthic habitats. Wolffish larvae remain near the bottom for up to six days after hatching, but gradually become more buoyant as the yolk sac is absorbed. **Juveniles**: (<65 cm total length): Juveniles EFH consists of sub-tidal benthic habitats at depths of 70–184 meters. Juveniles do not have a strong substrate preference. **Adults**: (≥65 cm total length): Wolfish EFH consists sub-tidal benthic habitats at depths less than 173 meters. Adult Atlantic wolffish have been observed spawning and guarding eggs in rocky habitats in less than 30 meters of water in the Gulf of St. Lawrence and Newfoundland and in deeper (50–100 meters) boulder reef habitats in the GoME. Egg masses have been collected on the Scotian Shelf in depths of 100–130 meters, indicating that spawning is not restricted to coastal waters. Adults are distributed over a wider variety of sand and gravel substrates once they leave rocky spawning habitats but are not observed over muddy bottom.
Barndoor skate (*Dipturus laevis*)	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: Barndoor skates have a relatively wide range which extends from Newfoundland to North Carolina. In southern New England, both juveniles and adults were most frequently observed in the summer, with few rare sightings of adults during the winter (Packer et al. 2003a). **Juveniles/Adults**: EFH includes benthic habitats on the continental shelf in depths between 40–400– –meters, and on the continental slope in depths up to 750 meters within Georges Banks and southern New England. Substrates included in the EFH are mud, sand, and gravel (NEFMC 2017).
Basking shark (*Cetorhinus maximus*)[c]	– –	– –	– –	– –	– –	●	●	●	– –	●	●	●	●	– –	●	●	●	●	●	●	– –	**General habitat description**: Basking sharks are generally observed in the northwestern and eastern Atlantic coastal regions from April to October and are thought to follow zooplankton distributions (Sims et al. 2003). Basking shark aggregations have been observed south and southeast of Long Island, east of Cape Cod, and along the coast of Maine (NOAA Fisheries 2017). Basking sharks are considered a Species of Concern because of interactions with vessels, being caught as bycatch, and low reproductive rates, which leads to slow recovery (NOAA Fisheries 2017). **Neonate/Juveniles/Adults**: EFH for juvenile and adult basking sharks is designated in the US Atlantic east coast pelagic waters from the GoME to the northern Outer Banks of North Carolina (NOAA Fisheries 2017).

Species	Eggs					Larvae/ Neonates					Juveniles					Adults					HAPC	EFH Description
	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank		
Bigeye Thresher Shark (*Alopias superciliosus*)	– –	– –	– –	– –	– –	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	– –	**General habitat description**: At this time, insufficient data is available to differentiate EFH between the juvenile and adult size classes; therefore, EFH is the same for those life stages. EFH in the Atlantic Ocean includes offshore pelagic habitats seaward of the continental shelf break between the seaward extent of the U.S. EEZ boundary on Georges Bank (off Massachusetts) to Georgia, and from the Blake Plateau to Biscayne Bay. EFH is associated with known habitat conditions including depth (frequently found between 25.5–50 meters), and temperature (20.05– –and 22°C). EFH in the Gulf of Mexico occurs off the southwestern edge of the West Florida Shelf to Key West, Florida, and between Desoto Canyon and pelagic habitats south of Galveston, Texas.– –
Bigeye Tuna (*Thunnus obesus*)	– –	– –	– –	– –	●	– –	– –	– –	– –	●	– –	– –	– –	– –	●	– –	– –	– –	– –	●	– –	**General habitat description**: Scientific knowledge of Atlantic bigeye tuna is limited. Its range is almost the entire Atlantic Ocean from 50° N latitude to 45° S latitude It is rarely caught in the Gulf of Mexico, and some of the points currently included in the EFH maps may require further validation (J. Lamkin pers. comm.). Smaller fish are probably restricted to the tropics, while larger individuals migrate to temperate waters. There is probably one population in the Atlantic Ocean (ICCAT 1997), although distinct northern and southern stocks should not be disregarded (SCRS 1997). Young 102 bigeye tuna form schools near the sea surface, mixing with other tuna such as yellowfin and skipjack tuna (Collette and Nauen 1983). **Spawning, eggs and larvae**: Insufficient information available within the U.S. EEZ; however, the Gulf of Guinea, off the coast of Africa, is identified as important habitat for spawning adults, eggs and larvae. Juveniles (<100 cm FL): Offshore pelagic habitats seaward of the continental shelf break between the seaward extent of the U.S. EEZ boundary on 103 Georges Bank (off Massachusetts) and the Blake Plateau (off Florida's east coast). Localized patches of EFH from southeast Florida through the Florida Keys to pelagic habitats seaward of the edge of the West Florida Shelf. EFH also includes pelagic habitats in the central and western Gulf of Mexico from the Alabama/Florida border to areas offshore of Texas. Localized EFH in the southern U.S. Caribbean and northeast of Puerto Rico. In all areas juveniles are found in depths greater than 200 meters. **Adults** (≥100 cm FL): Offshore pelagic habitats seaward of the continental shelf break between the seaward extent of the U.S. EEZ boundary on Georges Bank (off Massachusetts) and Cape Fear, North Carolina. EFH also includes pelagic habitats near the seaward edge of the U.S. EEZ off Georgia and the Blake Plateau, off southwestern portions of the West Florida Shelf, and in the central Gulf of Mexico in pelagic habitats roughly offshore between Apalachicola and the Louisiana/Texas border. In all areas adults are found in depths greater than 200 meters.

Species	Eggs					Larvae/ Neonates					Juveniles					Adults					HAPC	EFH Description
	Cable Area	WEA	Western -Central GoME	Scotian Shelf- Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf- Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf- Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf- Eastern GoME	Georges Bank		
Black Sea Bass (*Centropristis striata*)	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: Adult black sea bass are generally associated with structurally complex habitats. Juveniles and adults are commonly observed in the Gulf of Maine in the spring and fall (MAFMC 1998). **Eggs**: EFH is the estuaries where black sea bass eggs were identified in the ELMR database as common, abundant, or highly abundant for the "mixing" and "seawater" salinity zones. Generally, black sea bass eggs are found from May through October on the continental shelf, from southern New England to North Carolina. **Larvae**: 1) North of Cape Hatteras, EFH is the pelagic waters found over the continental shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina, in the highest 90% of all ranked ten-minute squares of the area where black sea bass larvae are collected in the MARMAP survey. 2) EFH also is estuaries where black sea bass were identified as common, abundant, or highly abundant in the ELMR database for the "mixing" and "seawater salinity zones. Generally, the habitats for the transforming (to juveniles) larvae are near the coastal areas and into marine parts of estuaries between Virginia and New York. When larvae become demersal, they are generally found on structured inshore habitat such as sponge beds. **Juveniles** (<19 cm TL): 1) Offshore, EFH is the demersal waters over the continental shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina, in the highest 90% of all the ranked squares of the area where juvenile black sea bass are collected in the NEFSC trawl survey. 2) Inshore, EFH is the estuaries where black sea bass are identified as being common, abundant, or highly abundant in the ELMR database for the mixing" and "seawater" salinity zones. Juveniles are found in the estuaries in the summer and spring. Generally, juvenile black sea bass are found in waters warmer than 6°C with salinities greater than 18 ppt and coastal areas between Virginia and Massachusetts, but winter offshore from New Jersey and south. Juvenile black sea bass are usually found in association with rough bottom, shellfish and eelgrass beds, man-made structures in sandy shelly areas; offshore clam beds and shell patches may also be used during the wintering. **Adults** (≥19 cm TL: 1): Offshore, EFH is the demersal waters over the continental shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina, in the highest 90% of all the ranked ten-minute squares of the area where adult black sea bass are collected in the NEFSC trawl survey. 2) Inshore, EFH is the estuaries where adult black sea bass were identified as being common, abundant, or highly abundant in the ELMR database for the "mixing" and seawater" salinity zones. Black sea bass are generally found in estuaries from May through October. Wintering adults (November through April) are generally offshore, south of New York to North Carolina. Temperatures above 6°C seem to be the minimum requirements. Structured habitats (natural and man-made), sand and shell are usually the substrate preference.

Species	Eggs					Larvae/ Neonates					Juveniles					Adults					HAPC	EFH Description
	Cable Area	WEA	Western -Central GoME	Scotian Shelf- Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf- Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf- Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf- Eastern GoME	Georges Bank		
Atlantic blue marlin (*Makaira nigricans*)	– –	– –	– –	– –	●	– –	– –	– –	– –	●	– –	– –	– –	– –	●	– –	– –	– –	– –	●	– –	**General habitat description**: Physiochemical attributes associated with the prevalence of blue marlin larvae in northern Gulf of Mexico waters include frontal zones, areas proximal to the Loop Current, lower sea surface temperature, and higher salinity. Adults are found primarily in the tropics within the 24°C isotherm, and make seasonal movements related to changes in sea surface temperatures. Adult blue marlin exhibit seasonal distributions in the Gulf of Mexico that correspond to sea surface temperature and chlorophyll (Kraus et al. 2011). The expanse of oxygen minimum zones has restricted blue marlin habitat to the upper, near-surface portion of these areas, as their physiology requires large amounts of oxygen (Stramma et al. 2011). Spawning, eggs, and larvae: EFH consists of most of the U.S. EEZ off southeastern Florida, through the Straits of Florida, and into the Gulf of Mexico from the Florida Keys to the continental shelf off of southern Texas. EFH extends from the 200-meter bathymetric line to the seaward extent of the U.S. EEZ. EFH also includes a portion of the western U.S. Caribbean between Puerto Rico and the U.S. EEZ (NOAA Fisheries 2017). **Juveniles**: (20–190 centimeters LJFL): EFH in the Atlantic Ocean extends from pelagic habitats south of Georges Bank to the Florida Keys, inclusive of the Blake Plateau and Charleston Bump, in depths greater than 200 meters. EFH in the Atlantic Ocean extends seaward to the U.S. EEZ boundary off Massachusetts, Virginia, Georgia, and Florida (NOAA Fisheries 2017). **Adults**: (≥190 cm LJFL): EFH in the Atlantic Ocean extends from pelagic habitats south of Georges Bank to the Florida Keys, inclusive of portions of the Blake Plateau and Charleston Bump, in depths >200 meters. EFH in the Atlantic Ocean extends seaward to the U.S. EEZ boundary north of the Carolinas and off the Blake Plateau; otherwise it is constricted somewhat around the continental shelf break. (NOAA Fisheries 2017).

Species	Eggs					Larvae/ Neonates					Juveniles					Adults					HAPC	EFH Description
	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank		
Bluefish (*Pomatomus saltatrix*)	●	●	●	●	– –	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: Bluefish inhabit pelagic waters in and north of the Middle Atlantic Bight for much of the year but make seasonal migrations south in the winter (Shepherd and Packer 2006). **Eggs/Larvae**: Eggs are found in mid-shelf waters ranging from 30–70 meters in GoME to Cape Hatteras. **Eggs** are not found in estuarine waters. Larvae are found in oceanic waters (Able and Fahay 1998; Shepherd and Packer 2006). Juvenile: EFH is all major estuaries between Penobscot Bay, Maine and St. Johns River, Florida (Shepherd and Packer 2006). **Adults**: Adults are found in oceanic, nearshore, and continental shelf). Adults are observed in the inland bays from May through October and are not associated with a specific substrate (Stone et al. 1994). The species migrates extensively and is distributed based on season and size of the individuals within the schools (Shepherd and Packer 2006). There are two predominant spawning areas on the east coast: one during the spring that is located offshore from southern Florida to North Carolina and the other during summer in the Mid-Atlantic Bight (Wilk 1982).
Blue shark (*Prionace glauca*)	– –	– –	– –	– –	– –	– –	– –	– –	– –	●	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: The blue shark is a pelagic, highly migratory species, occurring in temperate and tropical inshore and offshore waters, and ranging from Newfoundland and the Gulf of St. Lawrence south to Argentina (NOAA Fisheries 2017). Blue sharks prefer deep, clear waters with temperatures ranging from 10–20°C (Castro 1983), and are observed in New England from late May through October. Neonates: EFH follows the continental shelf south of Georges Bank to the outer extent of the U.S. EEZ in the GoME. **Juveniles/Adults**: EFH for juvenile and adult blue sharks is waters from the southern part of the GoME to Cape Hatteras (NOAA Fisheries 2017).
Common thresher shark (*Alopias vulpinus*)[b]	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: Common thresher sharks occur in coastal and oceanic waters but are more common within 5–14 meters of water depth (NOAA Fisheries 2017). All life stages: EFH for all life stages is coastal and pelagic waters within the GoME to Caps Hatteras, NC and in other localized areas off the Atlantic coast (NOAA Fisheries 2017).

Species	Eggs					Larvae/ Neonates					Juveniles					Adults					HAPC	EFH Description
	Cable Area	WEA	Western -Central GoME	Scotian Shelf- Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf- Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf- Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf- Eastern GoME	Georges Bank		
Deep-Sea Red Crab (*Chaceon quinquedens*)	– –	– –	– –	– –	●	– –	– –	– –	– –	●	– –	– –	– –	– –	●	– –	– –	– –	– –	●	– –	**General habitat description**: Red crab includes those areas of the offshore waters (out to the offshore U.S. boundary of the exclusive economic zone) that are along the southern flank of Georges Bank and south to Cape Hatteras, NC (NEFMC, 2002). **Eggs**: Red crab eggs are brooded attached to the underside of the female crab until they hatch and are released into the water column. Egg-bearing females are found on the shallow continental slope between 200–400 meters, where temperatures are typically between 4–10°C. The EFH designation for red crab eggs is the same as the distribution of egg-bearing females (200–400 meters) (NEFMC, 2002). **Larvae**: EFH for red crab larvae is the water column from the surface to the seafloor across the entire depth range identified for the species, 200–1,800 meters. Generally, red crab larvae are most commonly observed: water temperatures between 4– 25°C, salinities between 29–36 ppt, and dissolved oxygen between 5–8 ml/l. Red crab larvae appear to be most common during January–June (NEFMC, 2002). **Juveniles**: Bottom habitats of the continental slope with a substrate of silts, clays, and all silt-clay-sand composites within the depths of 700–1,800 meters. Generally, red crab juveniles are most commonly observed: water temperatures between 4–10°C, salinities of approximately 35 ppt, and dissolved oxygen between 3 and 7 mL/L. **Adults**: Bottom habitats of the continental slope with a substrate of silts, clays, and all silt-clay-sand composites within the depths of 200–1,300 meters along the southern flank of Georges Bank and south to Cape Hatteras. **Spawning Adults**: Bottom habitats of the continental slope with a substrate of silts, clays, and all silt-clay-sand composites within the depths of 200–1,300 meters. Generally, red crab adults are most commonly observed: water temperatures between 4–12°C, salinities of approximately 35 ppt, and dissolved oxygen between 3 and 8 mL/L.
Dusky Shark (Carcharhinus obscurus)	– –	– –	– –	– –	– –	– –	– –	– –	– –	●	– –	– –	– –	– –	●	– –	– –	– –	– –	●	– –	**General habitat description**: Dusky sharks migrate to northern areas of their range in the summer and return south in the fall as water temperatures decrease. Dusky shark is a Species of Concern because the northwestern Atlantic/Gulf of Mexico population is estimated at 15 to 20 percent of the mid-1970s abundance (Cortés et al. 2006). Although commercial and recreation fishing is prohibited, the main threat to the dusky shark population is from bycatch and illegal harvest. Neonate: EFH for neonate dusky shark includes offshore areas of southern New England to Cape Lookout, North Carolina (NOAA Fisheries 2017). **Juveniles**/**Adults**: EFH for juvenile and adult dusky sharks is waters over the continental shelf from southern Cape Cod to Florida (NMFS 2009).

Species	Eggs					Larvae/ Neonates					Juveniles					Adults					HAPC	EFH Description
	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank		
Golden Tilefish (Lopholatilus chamaeleonticeps)	– –	– –	– –	– –	– –	– –	– –	– –	– –	●	– –	– –	– –	– –	●	– –	– –	– –	– –	●	– –	**General habitat description**: Tilefish habitat is almost exclusively restricted to the outer continental shelf and upper continental slope (80–540 meters depth) south of the Gulf of Maine (Steimle et al. 1999a). **Eggs** and **Larvae**: EFH for tilefish eggs and larvae is the water column on the outer continental shelf and slope from the U.S./Canadian boundary to the Virginia/North Carolina boundary in mean water column temperatures between 7.5– 17.5°C (MAFMC 2008). **Juveniles** and **Adults**: EFH for tilefish juveniles and adults is semi-lithified clay substrate on the outer continental shelf and slope from the U.S./Canadian boundary to the Virginia/North Carolina boundary in bottom water temperatures which range from 9–14°C, which generally occur in depths between 100–300 meters. Tilefish create horizontal or vertical burrows in semi-lithified clay sediments, a substrate type with cohesive properties that allow the burrows to maintain their shape. Tilefish may also utilize rocks, boulders, scour depressions beneath boulders, and exposed rock ledges as shelter.
Haddock (Melanogrammus aeglefinus)	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: Haddock occurs throughout the GoME at various stages of its life history. **Eggs**: Pelagic habitats in coastal and offshore waters in the GoME, southern New England, and on Georges Bank (NOAA Fisheries 2017). **Larvae**: EFH consists of pelagic habitats in coastal and offshore waters in the GoME, the Mid-Atlantic, and on Georges Bank (NOAA Fisheries 2017) **Juveniles**: EFH for juvenile haddock consists of sub-tidal benthic habitats between 40–140 meters in the GoME, on Georges Bank, and in the Mid-Atlantic region, and as shallow as 20– –meters along the coast of Massachusetts, New Hampshire, and Maine. YOY juveniles settle on sand and gravel on Georges Bank but are found predominantly on gravel pavement areas within a few months after settlement. As they grow, they disperse over a greater variety of substrate types (NEFMC 2017). **Adults**: Sub-tidal benthic habitats between 50–160 meters in the GoME, on Georges Bank, and in southern New England. EFH for adult haddock occurs on hard sand (particularly smooth patches between rocks), mixed sand and shell, gravelly sand, and gravel substrates. They also are found adjacent to boulders and cobbles along the margins of rocky reefs in the GoME (NEFMC 2017).

Species	Eggs					Larvae/ Neonates					Juveniles					Adults					HAPC	EFH Description
	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank		
Little skate (Leucoraja erinacea)	●	●	●	●	– –	●	●	●	– –	●	●	●	●	●	●	●	●	●	●	●	– –	**General habitat description**: Demersal species that has a range from Nova Scotia to Cape Hatteras and is highly concentrated in the Mid-Atlantic Bight and on Georges Bank. Found year-round on Georges Bank and tolerates a wide range of temperatures (Packer et al. 2003b). Prefers sandy or pebbly bottom but can also be found on mud and ledges (Collette and Klein-MacPhee 2002). **Eggs**: Littel skate egg pouches are laid in pairs and can be found from Nova Scotia to Cape Hatteras. The egg pouches have sticky filaments that adhere them to bottom substrates. **Juveniles/Adults**: EFH is similar for both life stages and includes intertidal and sub-tidal benthic habitats in coastal waters of the GoME and in the mid-Atlantic region. EFH primarily occurs on sand and gravel substrates, but also is found on mud (NEFMC 2017).
Longbill spearfish (*Tetrapturus pfluegeri*)	– –	– –	– –	– –	●	– –	– –	– –	– –	●	– –	– –	– –	– –	●	– –	– –	– –	– –	●	– –	**General habitat description**: Longbill spearfish is known, but rare, from off the east coast of Florida, the Bahamas, and the Gulf of Mexico, and from Georges Bank to Puerto Rico. More recently it has been observed to be more widely distributed, mostly in the western Atlantic. The range for this species is from 40° N latitude to 35° S latitude It is an epipelagic, oceanic species, usually inhabiting waters above the thermocline (Nakamura 1985). **Spawning, eggs, larvae, Juveniles, and Adults**: EFH designation for juveniles and adults have been combined and are considered the same. EFH in the Atlantic Ocean extends from pelagic habitats south of Georges Bank to the Florida Keys, inclusive of the Blake Plateau and Charleston Bump, in depths >200 meters (NOAA Fisheries 2017).

Species	Eggs					Larvae/ Neonates					Juveniles					Adults					HAPC	EFH Description
	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank		
Longfin inshore squid (*Loligo pealeii*)	●	●	●	– –	– –	– –	– –	– –	– –	– –	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: Longfin inshore squids lay eggs in masses referred to as "mops" that are demersal and anchored to various substrates and hardbottom types, including shells, lobster pots, fish traps, boulders, submerged aquatic vegetation, sand, and mud (NOAA 2013). Female longfin squid lay these egg mops during three-week periods, which can occur throughout the year (Hendrickson 2017). **Eggs**: EFH for longfin inshore squid eggs is inshore and offshore bottom habitats from Georges Bank to Cape Hatteras (MAFMC AND NOAA FISHERIES 2011). **Juveniles**/**Adults**: EFH for juveniles and adults, also referred to as pre-recruits and recruits, is pelagic habitats inshore and offshore continental shelf waters from Georges Bank to South Carolina and in inshore waters of the GoME depths between 6–200 meters where bottom water temperatures are 8.5–14°C and salinities are 24–36.5 ppt (MAFMC and NOAA Fisheries 2011).
Monkfish (Lophius americanus)	●	●	●	●	●	●	●	●	●	●	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: Abundant throughout the GoME and Georges Bank. Prefer hard sand, pebbly bottom, gravel, and broken shells benthic habitats (Collette and Klein-MacPhee 2002; NEFMC 2017). **Eggs/Larvae**: Pelagic waters in the GoME, Georges Bank, southern New England, and the Mid-Atlantic south to Cape Hatteras (NEFMC 2017). Eggs occur at sea surface temperatures <18°C and in water depths from 15–1,000 meters, whereas larvae occur at water temperatures of 15°C and in water depths from 25–1,000 meters. Eggs are most often observed from March through September, and larvae are most often observed from March through September (Steimle et al. 1999b; NEFMC 2017). **Juveniles**/**Adults**: Demersal lifestages that inhabit bottom habitats with substrates of a sand-shell mix, algae-covered rocks, hard sand, pebbly gravel, or mud along the OCS in the Mid-Atlantic (NEFMC 2017). Juveniles occur at water temperatures below 13°C, at depths from 25–200 meters, and at salinities from 29.9–36.7 ppt. Adults occur at water temperatures below 15°C, at depths from 25–200 meters, and at salinities from 29.9–36.7 ppt (Steimle et al. 1999b, NEFMC 2017).

Species	Eggs					Larvae/ Neonates					Juveniles					Adults					HAPC	EFH Description
	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank		
Northern Shortfin Squid (*Illex illecebrosus*)	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: N. shortfin squid are found in oceanic and neritic habitats and adults undergo long distance migrations between boreal, temperate and subtropical waters. The N. Shortfin squid is found in waters mainly along the continental shelf edge from of the U.S. and Canada, between Newfoundland and Cape Hatteras, North Carolina (Hendrickson and Holmes 2004; MAFMC and NOAA Fisheries 2011). **Eggs**: Egg masses are pelagic and found mainly in the pelagic habitat along the continental slope. Pre-recruits: During the winter Pre-recruits migrate offshore and are abundant along the shelf edge and migrate into neritic water in at depth of 60 meters and greater between Georges Bank and Cape Hatteras and are most abundant along the shelf edge (Hendrickson and Holmes 2004; MAFMC and NOAA Fisheries 2011). **Adults**: Adult N. Shortfin squid utilize the shelf edge (at depths around 366 meters) between, GoME, Georges Bank, and Cape Hatteras during the winter and spring months (Hendrickson and Holmes 2004). As the water column along the continental slope warms up in the summer and autumn months adults are found both inshore and throughout the continental shelf (MAFMC and NOAA Fisheries 2011).
Ocean pout (*Macrozoarces americanus*)	●	●	●	– –	– –	– –	– –	– –	– –	– –	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: Ocean pout are present in southern New England from late summer to winter and prefer habitats that contain sandy mud, sticky sand, broken bottom, or on pebbles and gravel (Collette and Klein-MacPhee 2002). This species spawns in protected habitats, such as rock crevices and man-made artifacts (Steimle et al. 1999b; NEFMC 2017). **Eggs**: EFH for ocean pout eggs includes hardbottom habitats in the GoME, Georges Bank, and in the Mid-Atlantic Bight, as well as high-salinity zones in estuaries. **Eggs** are typically found in water depths less than 100 meters (Steimle et al. 1999b; NEFMC 2017). **Juveniles**: EFH for juveniles is intertidal and subtidal benthic habitats in the GoME and on the continental shelf north of Cape May, New Jersey, on the southern portion of Georges Bank, and in the high-salinity zones of bays and estuaries north of Cape Cod (NEFMC 2017). **Adults**: Adult EFH is subtidal benthic habitats in the GoME, on Georges Bank, in coastal and continental shelf waters north of Cape May, New Jersey, and in the high-salinity zones of bays and estuaries north of Cape Cod. Adult habitat includes mud and sand, particularly in association with structure forming habitat types like shell, gravel, or boulder (Steimle et al. 1999b; NEFMC 2017).

Species	Eggs					Larvae/ Neonates					Juveniles					Adults					HAPC	EFH Description
	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank		
Ocean Quahog (*Arctica islandica*)	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: Ocean quahog are found in federal waters from the eastern edge of Georges Bank and the Gulf of Maine throughout the Atlantic EEZ, in areas that encompass the top 90 percent of all the ranked ten-minute squares for the area where ocean quahogs were caught in the NEFSC surfclam and ocean quahog dredge surveys. Distribution in the western Atlantic ranges in depths from 9–244 meters. Ocean quahogs are rarely found where bottom water temperatures exceed 16°C and occur progressively further offshore between Cape Cod and Cape Hatteras (MAFMC 1998). **Juveniles**/**Adults**: Throughout the substrate, to a depth of 1 meter below the water/sediment interface (MAFMC 1998).
Offshore Hake (*Merluccius albidus*)	●	●	●	●	●	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: Juvenile and adult offshore hake EFH is identified as a depth range along the outer continental shelf and slopes extending from the Gulf of Maine to Cape Hatteras. NC in waters from 150–380 meters. Offshore hake are not strictly demersal and found utilizing the pelagic and benthic habitats (NEFMC 2017). **Eggs**: Pelagic habitats along the outer continental shelf and slope between 100–1,500 meters (NEFMC 2017). Spawning generally occurs between 330–550 meters. **Larvae**: Pelagic habitats along the outer continental shelf and slope between 60–1,500 meters (NEFMC 2017). **Juveniles**: Pelagic and benthic habitats on the outer continental shelf and slope in depths of 160–750 meters (NEFMC 2017). **Adults**: Pelagic and benthic habitats on the outer continental shelf and slope in depths of 200–750 meters (NEFMC 2017).

Species	Eggs					Larvae/ Neonates					Juveniles					Adults					HAPC	EFH Description
	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank		
Pollock (*Pollachius virens*)	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: Pollock eggs are buoyant upon fertilization and occur in the water column (Cargnelli et al. 1999a). The larval stage lasts between three and four months and is also pelagic. **Eggs**: EFH for pollock eggs is pelagic inshore and offshore habitat in the GoME, Georges Bank, and southern New England (NEFMC 2017). **Larvae**: EFH designations for larvae are similar to those for eggs and includes pelagic inshore and offshore habitats in the GoME, Georges Bank, and but larvae can be found farther south in the Mid-Atlantic region, with bays and estuaries also included in these regions (NEFMC 2017). **Juveniles**: Inshore and offshore pelagic and benthic habitats from the intertidal zone to 180– –meters in the Gulf of Maine, in Long Island Sound, and Narragansett Bay, between 40–180 meters on western Georges Bank and the Great South Channel, and in mixed and full salinity waters in a number of bays and estuaries north of Cape Cod. EFH for juvenile pollock consists of rocky bottom habitats with attached macroalgae (rockweed and kelp) that provide refuge from predators. Shallow water eelgrass beds are also essential habitats for YOY pollock in the Gulf of Maine. Older juveniles move into deeper water into habitats also occupied by adults (NEFMC 2017). **Adults**: Offshore pelagic and benthic habitats in the GoME and the southern portion of Georges Bank between 80–300 meters, and in shallower sub-tidal habitats in Long Island Sound, Massachusetts Bay, and Cape Cod Bay. Essential habitats for adult pollock are the tops and edges of offshore banks and shoals (e.g., Cashes Ledge) with mixed rocky substrates, often with attached macro algae (NEFMC 2017).
Porbeagle Shark (*Lamna nasus*)	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: Porbeagle sharks commonly inhabit deep, cold, temperate waters and forage primarily on fish and cephalopod species (NOAA Fisheries 2017). Porbeagle shark is a Species of Special Concern due to substantial population declines caused by overfishing (NOAA Fisheries 2017). All life stages: EFH for porbeagle shark includes offshore and coastal waters of the GoME (excluding Cape Cod and Massachusetts Bay) and offshore waters from Georges Bank to New Jersey. Porbeagle sharks are epipelagic in the summer months swimming in the upper 200 meters of the water column and move to deeper waters in the winter to depths of 200–1,000 meters (NOAA Fisheries 2017).

Species	Eggs					Larvae/ Neonates					Juveniles					Adults					HAPC	EFH Description
	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank		
Red hake (*Urophycis chuss*)	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: Juvenile red hake are pelagic and congregate around floating debris for a time before descending to the bottom (Steimle et al. 1999a). Although adult red hake are generally demersal, they can be found in the water column (Steimle et al. 1999a). **Eggs/Larvae**: EFH for red hake eggs and larvae is surface waters of the GoME, Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras. **Juveniles**: EFH for juvenile red hake is bottom habitats with a substrate of shell fragments. **Adults**: Adult EFH includes benthic habitats in the GoME and the outer continental shelf and slope in depths of 50–750 meters and as shallow as 20 meters in a number of inshore estuaries and embayments as far south as Chesapeake Bay. Shell beds, soft sediments (mud and sand), and artificial reefs provide EFH for adult red hake.
Rosette Skate (*Leucoraja garmani*)	– –	– –	– –	– –	●	– –	– –	– –	– –	– –	– –	– –	– –	– –	●	– –	– –	– –	– –	●	– –	**General habitat description**: For rosette skate, EFH is designated anywhere within the geographic areas in water of 80–400 meters from Gulf of Maine to Cape Hatteras, NC (Packer et. al. 2003c). **Juveniles** and **Adults**: Benthic habitats with mud and sand substrates on the outer continental shelf in depths of 80– 400 meters from approximately 40°N latitude to Cape Hatteras, NC (NEFMC 2017).
Roundscale Spearfish (*Tetrapturus georgii*)	– –	– –	– –	– –	●	– –	– –	– –	– –	– –	– –	– –	– –	– –	●	– –	– –	– –	– –	●	– –	**General habitat description**: Spawning, eggs, and larvae: Insufficient information available to designate EFH (MAFMC 2008). Juvenile: Pelagic habitats seaward of the continental shelf (depths >200 meters) south of Georges Bank to the outer extent of the U.S. EEZ; from Cape Cod to Cape Fear, North Carolina; and from southern South Carolina to the southeastern coast of Florida (close to Jupiter Inlet [MAFMC 2008]) . **Adults**: Pelagic habitats seaward of the continental shelf (depths >200 meters) south of Georges Bank to the outer extent of the U.S. EEZ and from Cape Cod to the mid-east coast of Florida (MAFMC 2008).
Sand Tiger Shark (*Carcharias taurus*)	– –	– –	– –	– –	– –	●	●	●	– –	●	●	●	●	– –	– –	●	●	●	– –	– –	– –	**General habitat description**: Neonate sand tiger sharks inhabit shallow coastal waters within the 25-meter isobath (NOAA Fisheries 2017). The sand tiger shark is a Species of Concern because population levels are estimated to be only 10 percent of pre-fishery conditions. Neonates: EFH for sand tiger shark neonates is along the U.S. Atlantic east coast from Cape Cod to northern Florida. **Juveniles**: EFH for juvenile sand tiger sharks is designated in estuarine bay habitats from northern Florida to Cape Cod (NOAA Fisheries 2017). **Adults**: EFH for adult sand tiger sharks includes inshore bay and adjacent coastal and offshore waters throughout the Mid Atlantic (NOAA Fisheries 2017).

Species	Eggs					Larvae/ Neonates					Juveniles					Adults					HAPC	EFH Description
	Cable Area	WEA	Western -Central GoME	Scotian Shelf- Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf- Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf- Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf- Eastern GoME	Georges Bank		
Sandbar Shark (*Carcharhinus plumbeus*)	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	●	●	●	– –	●	●	– –	– –	– –	●	– –	**General habitat description**: Sandbar sharks are a bottom-dwelling shark species that primarily forages for small bony fishes and crustaceans (NMFS 2009). **Juveniles**: EFH for juvenile sandbar shark includes coastal areas of the U.S. Atlantic between southern New England and Georgia (NOAA Fisheries 2017). **Adults**: EFH for adult sandbar sharks is coastal areas from southern New England to Florida (NOAA Fisheries 2017).
Scup (*Stenotomus chrysops*)	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: Scup occupy inshore areas in the spring, summer, and fall and migrate offshore to overwinter in warmer waters on the Outer Continental Shelf (Steimle et al. 1999b). Scup was a dominant finfish species captured in the NEFSC multispecies bottom trawl survey during spring, summer, and fall surveys and in the Massachusetts Division of Marine Fisheries trawl surveys in the spring and fall. **Spawning and eggs**: Scup spawn and eggs are found within the inner continental shelf from off southern New England from May through August, with peaks in June and July (NOAA 2013). **Larvae**: Scup larvae are found in coastal waters during spring and summer months. **Juveniles/Adults**: EFH for juvenile and adult scup are the inshore and offshore demersal waters over the continental shelf from the Gulf of Maine to Cape Hatteras (NOAA 2013).
Shortfin Mako Shark (*Isurus oxyrinchus*)	– –	– –	– –	– –	– –	– –	– –	– –	– –	●	– –	– –	– –	– –	●	– –	– –	– –	– –	●	– –	**General habitat description**: EFH for shortfin mako sharks in the Atlantic Ocean includes pelagic habitats seaward of the continental shelf break between the seaward extent of the U.S. EEZ boundary on Georges Bank (off Massachusetts) to Cape Cod (seaward of the 200-meter bathymetric line); coastal and offshore habitats between Cape Cod and Cape Lookout, North Carolina; and localized habitats off South Carolina and Georgia (NOAA Fisheries 2017). All life stages: EFH for all life stages is combined and considered the same due to insufficient data needed to differentiate EFH by life stage (NOAA Fisheries 2017).
Silky Shark (*Carcharhinus falciformis*)	– –	– –	– –	– –	– –	– –	– –	– –	– –	●	– –	– –	– –	– –	●	– –	– –	– –	– –	●	– –	**General habitat description**: The silky shark is an offshore, epipelagic shark, but juveniles venture inshore during the summer. In the western Atlantic, it ranges from Massachusetts to Brazil including the Gulf of Mexico and Caribbean Sea (NOAA Fisheries 2017) Neonate/YOY, Juvenile, and Adult: EFH includes offshore, pelagic waters of the U.S. EEZ. Atlantic east coast from Florida to Massachusetts (NOAA Fisheries 2017).

Species	Eggs					Larvae/ Neonates					Juveniles					Adults					HAPC	EFH Description
	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank		
Silver hake (*Merluccius bilinearis*)	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: This groundfish species prefers deep water environments and are concentrated in deep basins in the GoME and along the continental slope in winter and spring. Silver hake associate with all bottom types, from gravel to fine silt and clay, but mainly with silts and clay (Lock and Packer 2004). **Eggs/Larvae**: EFH for eggs and larvae include pelagic habitats from the GoME, Georges Bank, the continental shelf off southern New England, and the Mid-Atlantic south to Cape Hatteras (NEFMC 2017). **Juveniles**: Juveniles inhabit sand waves, flat sand with amphipod tubes, and shells, and in biogenic depressions. Juvenile EFH includes pelagic and benthic habitats (e.g., sandy substrates) in selected coastal bays and estuaries and on the continental shelf as far south as Cape May, New Jersey. Juveniles inhabit depths greater than 10 meters in coastal waters in the Mid-Atlantic and between 40–400 meters) in the GoME, Georges Bank, and middle continental shelf in the Mid-Atlantic. **Adults**: Adults are observed in water temperatures below 22°C and at depths between 20–270 meters in benthic habitats of all substrate types. Adults occur in the GoME, on Georges Bank, and on the continental shelf off southern New England, and the Mid Atlantic south to Cape Hatteras (NEFMC 2017).
Skipjack Tuna (*Katsuwonus pelamis*)	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	●	– –	– –	●	– –	●	– –	**General habitat description**: Skipjack tuna are circumglobal in tropical and warm-temperate waters, generally limited by the 15°C isotherm. In the western Atlantic skipjack tuna range as far north as Newfoundland (Vinnichenko 1997) and as far south as Brazil (Collette and Nauen 1983). Skipjack tuna are an epipelagic and oceanic species and may dive to a depth of 260 meters during the day. Skipjack tuna is also a schooling species, forming aggregations associated with hydrographic fronts (Collette and Nauen 1983). There has been no trans-Atlantic recovery of tags; eastern and western stocks are considered separate (ICCAT 1997). **Eggs/Larvae**: In offshore waters in the Gulf of Mexico to the EEZ and portions of the Florida Straits (NOAA Fisheries 2017). **Juveniles**: Offshore pelagic habitats seaward of the continental shelf break between the seaward extent of the U.S. EEZ boundary on Georges Bank (off Massachusetts); coastal and offshore habitats between Massachusetts and South Carolina; localized in areas off Georgia and South Carolina; and from the Blake Plateau through the Florida Straits. Offshore waters in the central Gulf of Mexico from Texas through the Florida Panhandle. In all areas juveniles are found if waters >66 feet. **Adults**: Coastal and offshore habitats between Massachusetts and Cape Lookout, North Carolina and localized areas in the Atlantic off South Carolina and Georgia, and the northern east coast of Florida. EFH in the Atlantic Ocean also located on the Blake Plateau and in the Florida Straits through the Florida Keys. EFH also includes areas in the central Gulf of Mexico, offshore in pelagic habitats seaward of the southeastern edge of the West Florida Shelf to Texas (NOAA Fisheries 2017).

Species	Eggs					Larvae/ Neonates					Juveniles					Adults					HAPC	EFH Description
	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank		
Smooth Skate (*Malacoraja senta*)	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: Smooth skate EFH includes bay and estuaries (juveniles) to depths of 900 meters within the GoME south of Cape Cod but not extending into S. New England (NEFMC 2017). **Juveniles**: Juvenile EFH consists of benthic habitats between 100–400 meters in the GoME and on the continental slope to depths of 900– –meters, and in high salinity zones of bays and estuaries along the Maine coast (NEFMC 2017). EFH for juvenile is on soft mud in deeper areas, but also on sand, shell hash, gravel, and pebbles on offshore banks in the GoME (NEFMC 2017). **Adults**: Adult EFH includes benthic habitats between 100–400 meters in the GoME and on the continental slope to depths of 900 meters (NEFMC 2017).
Spiny dogfish (Squalus acanthias)	– –	– –	– –	– –	– –	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: The spiny dogfish is widely distributed throughout the world, with populations existing on the continental shelf of the northern and southern temperate zones, which includes the North Atlantic from Greenland to northeastern Florida, with concentrations from Nova Scotia to Cape Hatteras. Based on seasonal temperatures, spiny dogfish migrate up to 1,600 kilometers along the east coast (Bullard 2014). Neonates: Pelagic and epibenthic habitats, primarily in deep water on the outer continental shelf and slope between Cape Hatteras and Georges Bank and in the Gulf of Maine. Young are born mostly on the offshore wintering grounds from November to January, but newborns (neonates or “pups”) are sometimes taken in the Gulf of Maine or southern New England in early summer (MAFMP 2014). **Juveniles**/**Adults**: EFH for juvenile and adult spiny dogfish is waters on the continental shelf from the GoME through Cape Hatteras (NOAA 2013). NEFSC bottom trawl surveys collected spiny dogfish juveniles at depths ranging from 11–500 meters. Adults are found in deeper waters inshore and offshore from the shallows to 900 meters (Bullard 2014).
Summer flounder (*Paralichthys dentatus*)	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: Eggs are generally observed between October and May, while larvae are found from September through February. Juvenile summer flounder inhabit inshore areas such as salt marsh creeks, seagrass beds, and mudflats in the spring, summer, and fall and move to deeper waters offshore in the winter. Adults inhabit shallow coastal and estuarine areas during the warmer seasons and migrate offshore during the winter (Packer and Hoff 1999; MAFMC 1998). **Eggs**/**Larvae**: EFH for eggs and larvae is pelagic waters found over the continental shelf from the GoME to Cape Hatteras. **Juveniles**/**Adults**: EFH for juvenile and adult summer flounder is demersal waters over the continental shelf from the GoME to Cape Hatteras. HAPC is designated as areas of all native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations, within adult and juvenile summer flounder EFH (Packer and Hoff 1999; MAFMC 1998).

Species	Eggs					Larvae/ Neonates					Juveniles					Adults					HAPC	EFH Description
	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank		
Swordfish (*Xiphias gladius*)	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	●	– –	– –	– –	– –	●	– –	**General habitat description**: Swordfish are circumglobal, ranging through tropical, temperate, and sometimes cold-water regions. Their latitudinal range is from 50° to 40° N latitude to 45° S latitude in the western Atlantic, and 60° to 45° N latitude to 50° S latitude in the eastern Atlantic (Nakamura 1985). Swordfish are epipelagic to meso-pelagic, and are usually found in waters warmer than 13°C. Their optimum temperature range is believed to be 18–22°C, but they will dive into 5–10°C waters at depths of up to 650 meters (Nakamura 1985). Swordfish migrate diurnally, coming to the surface at night (Palko et al. 1981). **Spawning, eggs, and larvae**: Atlantic Ocean from off Cape Hatteras, North Carolina extending south around through the east coast of Florida continuing to pelagic habitats in the western Gulf of Mexico (off Texas) that are seaward from the 200 meters isobath to the EEZ boundary. EFH is strongly associated with the Loop Current boundaries in the Gulf and the western edge of the Gulf Stream in the Atlantic. EFH also includes pelagic habitats in the eastern U.S. Caribbean from the 200-meter isobath to the EEZ boundary (NOAA Fisheries 2017). **Juveniles**: Offshore pelagic habitats, seaward of the continental shelf break, between Georges Bank and the Florida Keys, and from the Florida Keys to pelagic habitats off the coast of Texas. EFH in the U.S. Caribbean includes localized areas around Puerto Rico and the Virgin Islands, and in southern portions of the U.S. Caribbean. EFH is in depths >200 meters in all areas (NOAA Fisheries 2017). **Adults**: Offshore pelagic habitats, seaward of the continental shelf break, between Georges Bank and the Florida Keys. EFH extends from the continental shelf to the U.S. EEZ boundary off Massachusetts, Virginia, and from South Carolina through the Florida Keys (NOAA Fisheries 2017).
Thorny Skate (*Amblyraja radiata*)	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: Thorny skate EFH includes bay and estuaries (juveniles) to depths of 900 meters within the GoME south of Cape Cod but not extending into S. New England (NEFMC 2017). **Eggs**: Thorny skates are thought to release their egg cases April–September within the habitats described for adult thorny skates (Packer et. al. 2003d). **Juveniles**: Benthic habitats between 35–400 meters in the GoME, on the continental slope to a depth of 900 meters, and in shallower water in the high salinity zones in bays and estuaries north of Cape Cod. EFH for juveniles is found a diverse suite of benthic habitats, including sand, gravel, broken shells, pebbles, and soft mud (NEFMC 2017). **Adults**: Benthic habitats between 80–300 meters in the GoME and extending south of Cape Cod on the continental slope to a depth of 900 meters (NEFMC 2017). EFH for adult thorny skates is found on a wide variety of bottom types, including sand, gravel, broken shells, pebbles, and soft mud (NEFMC 2017).

Species	Eggs					Larvae/ Neonates					Juveniles					Adults					HAPC	EFH Description
	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank		
Tiger Shark (*Galeocerdo cuvier*)	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	●	– –	– –	– –	– –	●	– –	**General habitat description**: Tiger sharks are a warm-water shark species and primarily remain south of the Mid-Atlantic Bight; however, they will occasionally travel farther north during the warmer summer months (NEFMC 2017). **Juveniles/Adults**: EFH for these life stages extends from Georges Bank to the Florida Keys in offshore pelagic habitats associated with the continental shelf break at the seaward extent of the U.S. EEZ boundary (NEFMC 2017).
White Hake (*Urophycis tenuis*)	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: This groundfish species prefers deep water environments and is predominantly found along the edge of the OCS between Cape Hatteras and Cape Cod, becoming more prevalent on the coastal shelf and inshore waters moving northward into the GoME (Chang et al. 1999). **Eggs**: EFH for White hake eggs is pelagic habitats throughout the GoME, including Massachusetts and Cape Cod bays, and the outer continental shelf and slope (NEFMC 2017; Chang et al. 1999). **Larvae**: Larvae EFH is the pelagic habitats in the GoME, in southern New England, and on Georges Bank. Early stage white hake larvae have been collected on the continental slope, but cross the shelf-slope front and use nearshore habitats for juvenile nurseries (NEFMC 2017; Chang et al. 1999). **Juveniles**: Intertidal and sub-tidal estuarine and marine habitats in the GoME, on Georges Bank, and in southern New England, including mixed and high salinity zones in a number of bays and estuaries north of Cape Cod, to a maximum depth of 300 meters. Pelagic phase juveniles remain in the water column for about 2 months. In nearshore waters, EFH for benthic phase juveniles occurs on fine-grained, sandy substrates in eelgrass, macroalgae, and un-vegetated habitats (NEFMC 2017). **Adults**: Sub-tidal benthic habitats in the GoME, including depths >25 meters in certain mixed and high salinity zones portions of a number of bays and estuaries, between 100–400 meters in the outer gulf. EFH for adult white hake occurs on fine-grained, muddy substrates and in mixed soft and rocky habitats (NEFMC 2017). Spawning takes place in deep water on the continental slope (NEFMC 2017).

Species	Eggs					Larvae/ Neonates					Juveniles					Adults					HAPC	EFH Description
	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank		
White Marlin (*Kajikia albida*)	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	●	– –	– –	– –	– –	●	– –	**General habitat description**: White marlin is an oceanic, epipelagic species that occurs in the Atlantic Ocean, Gulf of Mexico, and Caribbean waters. It inhabits almost the entire Atlantic from 45° N to 45° S latitude in the western Atlantic and 45° N latitude to 35° S latitude in the eastern Atlantic (NOAA Fisheries 2017). Juvenile: In depths >200 meters in all areas of the EEZ. Pelagic habitats south of Georges Bank to the outer extent of the U.S. EEZ, and from Cape Cod to the Florida Keys (inclusive of the Charleston Bump and the Blake Plateau [NOAA Fisheries 2017]). **Adults**: In depths >200 meters in all areas of the EEZ. Pelagic habitats south of Georges Bank to the outer extent of the U.S. EEZ, from Cape Cod to NC, on the Blake Plateau, and in the Florida Straits between Cape Canaveral and the southwestern edge of the West Florida Shelf (NOAA Fisheries 2017).
White Shark (*Carcharodon carcharias*)	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: The white shark ranges within all temperate and tropical belts of oceans, including the Mediterranean Sea. The white shark occurs in coastal and offshore waters and has a very sporadic presence. Because of the shark's sporadic presence, very little is known about its breeding habits. Sightings of the white shark in the Mid-Atlantic Bight occur from April to December. The white shark prefers open ocean habitat. **Juveniles**/**Adults**: EFH for juvenile and adult white shark is combined and includes inshore waters out to 57 nautical miles from Cape Ann, Massachusetts to Cape Canaveral, Florida (NOAA Fisheries 2017).
Windowpane flounder (*Scophthalmus aquosus*)	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	– –	**General habitat description**: Windowpane flounder are usually associated with non-complex benthic habitats (Collette and Klein-MacPhee 2002) from the Gulf of Saint Lawrence to Florida (Gutherz 1967). Spawning occurs from April to December along areas of the northwest Atlantic (NEFMC 2017). **Eggs**: EFH for eggs is surface waters around the perimeter of the GoME, Georges Bank, southern New England, and the middle Atlantic south to Cape Hatteras (NEFMC 2017). **Larvae**: EFH for larvae is pelagic waters around the perimeter of the GoME, Georges Bank, southern New England, and the middle Atlantic south to Cape Hatteras (NEFMC 2017). Juvenile/**Adults**: EFH for juvenile and adult life stages is bottom habitats that consist of mud or fine-grained sand substrate around the perimeter of the GoME, Georges Bank, southern New England, and the middle Atlantic south to Cape Hatteras (NEFMC 2017).

Species	Eggs					Larvae/ Neonates					Juveniles					Adults					HAPC	EFH Description
	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank		
Winter Flounder (*Pseudopleuronectes americanus*)	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: This groundfish fish species inhabits coastal waters from the Strait of Belle Isle, Newfoundland to Georgia (Collette and Klein-MacPhee 2002). Winter flounder are abundant in New Jersey waters and prefers muddy, sandy, cobbled, gravely, or boulder substrates (Pereira et al. 1999), and. spawns over sandy bottom in shallow habitats (NEFMC 2017). **Eggs**/Larvae: Eggs are typically found over mud, muddy sand, sand, gravel, macroalgae, and SAV. Pelagic **Larvae** hatch in nearshore waters and estuaries or are transported shoreward from offshore spawning sites where they metamorphose and settle to the bottom as juveniles (Pereira et al. 1999; NEFMC 2017). **Juveniles**/**Adults**: Juveniles and adults are found in estuarine, coastal, and continental shelf benthic habitats, as well as the mixed and high salinity zones in GoME bays and estuaries (NEFMC 2017). EFH extends from the intertidal zone to depths of 60 meters for juveniles and 70 meters for adults. Juveniles are found inshore on muddy and sandy sediments in and adjacent to eelgrass and macroalgae, in bottom debris, and in marsh creeks. Adult EFH occurs on muddy and sandy substrates, and on hard bottom on offshore banks (Pereira et al. 1999; NEFMC 2017).
Winter skate (*Leucoraja ocellata*)	●	●	●	●	●	– –	– –	– –	– –	– –	●	●	●	●	●	●	●	●	●	●	– –	**General habitat description**: Demersal species that has a range from the southern coast of Newfoundland to Cape Hatteras and has concentrated populations on Georges Bank and the northern section of the Mid-Atlantic Bight (Packer et al. 2003e; NEFMC 2017). The winter skate has very similar temperature ranges and migration patterns as the little skate (NEFMC 2017). Egg: Winter skate deposit a single egg in egg during the summer and fall off Nova Scotia and the Gulf of Maine with egg deposition continuing into December and January off southern New England. **Juveniles**/**Adults**: EFH for juvenile and adult winter skate includes sand and gravel substrates in sub-tidal benthic habitats in depths from the shore to 90 meters from eastern Maine to Delaware Bay, on the continental shelf in southern New England and the mid-Atlantic region, and on Georges Bank (NEFMC 2017).

Species	Eggs					Larvae/ Neonates					Juveniles					Adults					HAPC	EFH Description
	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western -Central GoME	Scotian Shelf-Eastern GoME	Georges Bank		
Witch flounder (*Glyptocephalus cynoglossus*)	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: Witch flounder a groundfish species range from the GoME to Cape Hatteras, North Carolina (Cargnelli et al. 1999b), and tend to concentrate near the southwest portion of the GoME (Collette and Klein-MacPhee 2002). Spawning occurs from May through September and peaks in July and August. **Eggs**: EFH for eggs is surface waters of the GoME, Georges Bank, the continental shelf off southern New England, and the Mid-Atlantic south to Cape Hatteras (NEFMC 2017). **Larvae**: EFH for larvae is surface waters to 250 meters in the GoME, Georges Bank, the continental shelf off southern New England, and the Mid-Atlantic Bight south to Cape Hatteras (NEFMC 2017). **Juveniles/Adults**: They are found over mud, clay, silt, or muddy sands at depths ranging from 20–1,565 meters although the majority are found at 90–300 meters (Cargnelli et al. 1999b, NEFMC 2017).
Yellowfin Tuna (*Thunnus albacares*)	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: Albacore tuna is a circumglobal, epipelagic species, and its life cycle is poorly known. In the Atlantic Ocean, albacore tuna range from between 40° and 45°– –N latitude to 40° S latitude **Juveniles**: Offshore, pelagic habitats of the Atlantic ocean from the outer edge of the U.S.– –EEZ through Georges Bank to pelagic habitats south of Cape Cod, and from Cape Cod to Cape Hatteras NC (NOAA Fisheries 2017). **Adults**: Offshore, pelagic habitats of the Atlantic Ocean from the outer edge of the U.S.– –EEZ through Georges Bank to pelagic habitats south of Cape Cod, and from Cape Cod to Cape Hatteras, North Carolina (NOAA Fisheries 2017). EFH also includes offshore pelagic habitats near the outer U.S. EEZ between North Carolina and Florida, and offshore pelagic habitats associated with the Blake Plateau (NOAA Fisheries 2017).

Species	Eggs					Larvae/ Neonates					Juveniles					Adults					HAPC	EFH Description
	Cable Area	WEA	Western-Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western-Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western-Central GoME	Scotian Shelf-Eastern GoME	Georges Bank	Cable Area	WEA	Western-Central GoME	Scotian Shelf-Eastern GoME	Georges Bank		
Yellowtail flounder (*Limanda ferruginea)*	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	●	●	●	– –	●	– –	**General habitat description**: This groundfish species range along the Atlantic coast of North America from Newfoundland to the Chesapeake Bay, with the majority located on the western half of Georges Bank, the western GoME, east of Cape Cod, and southern New England (Collette and Klein-MacPhee 2002). Present on Georges Bank from March to August. Spawning occurs in both inshore areas as well as offshore on Georges Bank in July (NEFMC 2017). **Eggs**: EFH for eggs is the coastal and continental shelf pelagic habitats in the GoME, on Georges Bank, and in the Mid-Atlantic region as far south as the upper Delmarva peninsula, including the high salinity zones of the bays and estuaries throughout the central Massachusetts to Cape Cod bay (NEFMC 2017). **Larvae**: Coastal marine and continental shelf pelagic habitats in the GoME, and from Georges Bank to Cape Hatteras, including the high salinity zones of the bays and estuaries throughout the central Massachusetts to Cape– –Cod bay (NEFMC 2017). **Juveniles**: Sub-tidal benthic habitats in coastal waters in the GoME and on the continental shelf on Georges Bank and in the Mid-Atlantic, including the high salinity zones of the bays and estuaries throughout the central Massachusetts to Cape Cod bay (NEFMC 2017). EFH for juvenile yellowtail flounder occurs on sand and muddy sand between 20–80 meters (NEFMC 2017). **Adults**: Sub-tidal benthic habitats in coastal waters in the GoME and on the continental shelf on Georges Bank and in the Mid-Atlantic including the high salinity zones of the bays and estuaries throughout the central Massachusetts to Cape Cod Bay (NEFMC 2017). EFH for adult yellowtail flounder occurs on sand and sand with mud, shell hash, gravel, and rocks at depths between 25–90 meters (NEFMC 2017).

– –= life stage is not expected to occur, ● life stage is expected to occur

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Appendix B Summary of Avoidance, Minimization and Mitigation Measures

Table B-1. Summary of Avoidance, Minimization and Mitigation Measures – Location: Offshore project area

Project Stage	Adverse Effect	Avoidance, Minimization, and Mitigation
Met Buoy-based Acoustic Monitoring –Deployment and Maintenance, and Decommissioning	Vessel traffic and space-use conflicts – indirect, short term	Vessels of all sizes must operate at 11.5 mph (18.5 kph or 10 knots) or less between October 1 and May 30 and while operating port to port and operating in the lease area, or in the transit area to and from ports in Maine, New Hampshire, and Massachusetts.
	Entanglement – direct adverse impact but with a very low probability of occurrence	Ensure any mooring systems used during data collection activities are 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: 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. 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. 2. Any equipment included 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. 3. When practicable, buoys should be lowered and raised slowly to minimize risk to listed species and benthic habitat. No buoys should be deployed or retrieved if large whales or sea turtles are sighted within 1,640 feet (500 meters) of the buoy being deployed/retrieved. 4. If a live or dead marine protected species becomes entangled, operators must immediately contact the applicable stranding network coordinator using the reporting contact details and provide any on-water assistance requested. 5. All buoys must be properly labeled with owner and contact information.

Project Stage	Adverse Effect	Avoidance, Minimization, and Mitigation
Met Buoy-based Acoustic Monitoring –Deployment and Maintenance, and Decommissioning (cont'd)	Lighting – indirect, short term, and mostly unmeasurable	Same as above.
	Air emissions – indirect, short term	
	Vessel discharges – indirect, short term	
	Seafloor disturbance – direct but minimal	
Geophysical Reconnaissance Surveys and High-Resolution Geophysical Surveys	Vessel traffic and space-use conflicts – indirect, short term	Vessels of all sizes must operate at 11.5 mph (18.5 kph or 10 kn) or less between October 1 and May 30 and while operating port to port and operating in the lease area, or in the transit area to and from ports in Maine, New Hampshire, and Massachusetts.
	Noise – indirect, short term	To avoid injury of and minimize any potential disturbance to protected species, implement the following measures for all vessels using boomer, sparker, bubble gun, and chirp sub-bottom profiler categories of equipment. Shutdown, pre-start clearance, and ramp-up procedures are not required during HRG survey operations using only other sources (e.g., ultra-short baselines, fathometers, parametric shallow penetration sub-bottom profilers, hull-mounted non-parametric sub-bottom profiler, side-scan sonars, pingers, acoustic releases, echosounders, and instruments attached to submersible vehicles (HOV/AUV/ROVs). The Shutdown Zone(s) must be monitored by third-party PSOs at all times when boomer, sparker, bubble gun, or Chirp sub-bottom profiler categories of equipment are being operated and all observed ESA-listed species must be recorded. A "ramp up" of the boomer, sparker, or bubble gun survey equipment must occur at the start or re-start of geophysical survey activities when technically feasible. A ramp up must begin with the power for the geophysical survey equipment ramped up half power for 5 minutes, and then to full power.

Project Stage	Adverse Effect	Avoidance, Minimization, and Mitigation
Geophysical Reconnaissance Surveys and High-Resolution Geophysical Surveys (cont'd)	Lighting – indirect, short term	Same as above.
	Entanglement – direct, very short term	
	Air emissions – indirect, short term	
	Vessel discharges – indirect, very short term	
Geotechnical Surveys	Vessel traffic and space-use conflicts – indirect, short term	Vessels of all sizes must operate at 11.5 mph (18.5 kph or 10 knots) or less between October 1 and May 30 and while operating port to port and operating in the lease area, or in the transit area to and from ports in Maine, New Hampshire, and Massachusetts.
	Seafloor disturbance – direct, very short term	All vessel anchoring and any seafloor-sampling activities are restricted from seafloor areas with deep/cold-water coral reefs and shallow/mesophotic reefs. All vessel anchoring and seafloor sampling must also occur at least 492 feet (150 meters) 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 habitat.
		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 to 0.5 parts per thousand) 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.
	Noise – indirect, short term	
	Air emissions – indirect, short term	
	Vessel discharges – indirect, very short term	
	Lighting – indirect, short term	

Project Stage	Adverse Effect	Avoidance, Minimization, and Mitigation
Benthic Surveys	Seafloor disturbance – direct, very short term	All vessel anchoring and any seafloor-sampling activities are restricted from seafloor areas with deep/cold-water coral reefs and shallow/mesophotic reefs. All vessel anchoring and seafloor sampling must also occur at least 492 feet (150 meters) 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 habitat.
	Entanglement – direct, very short term	
	Noise – indirect, short term	
	Lighting – indirect, short term	
	Vessel discharges – indirect, very short term	
Seafloor Habitat Characterization Sampling and Surveys	Vessel traffic and space-use conflicts – indirect, short term	Vessels of all sizes must operate at 11.5 mph (18.5 kph or 10 knots) or less between October 1 and May 30 and while operating port to port and operating in the lease area, or in the transit area to and from ports in Maine, New Hampshire, and Massachusetts.
	Seafloor disturbance – direct, very short term	All vessel anchoring and any seafloor-sampling activities are restricted from seafloor areas with deep/cold-water coral reefs and shallow/mesophotic reefs. All vessel anchoring and seafloor sampling must also occur at least 492 feet (150 meters) 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 habitat.
		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 to 0.5 parts per thousand) 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.
	Noise – indirect, short term	
	Air emissions – indirect, short term	
	Vessel discharges – indirect, very short term	
	Lighting – indirect, short term	

Project Stage	Adverse Effect	Avoidance, Minimization, and Mitigation
Physical Oceanographic Monitoring	None	None
Digital Aerial Surveys, Visual Wildlife Surveys, and Passive Acoustic Monitoring of Marine Mammals and Ambient Noise	None	None
Motus Tracking	None	None
Active Acoustic Surveys and Environmental DNA (eDNA) Sampling of Marine Fish and Invertebrates	Short term minor to individuals tagged	None
Passive Acoustic Monitoring of Large Pelagic and Benthic Fish	None	None
Plankton and Larval Lobster Surveys	Entanglement – direct adverse impact but with a very low probability of occurrence	The Lessee must ensure that all trap/pot gear follow required best practices, including: All sampling gear will be hauled at least once every 30 days, and all 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 (less than 1,700-pound [771-kilogram] breaking strength).