Appendix O

Assessment of Resources with Moderate (or Lower) Impacts

Contents

List of Tables

List of Figures

This page was intentionally left blank.

O.1 Introduction

To focus on the impacts of most concern in the main body of this Final EIS, BOEM has included the analysis of resources with no greater than **moderate** adverse impacts below. These include air quality; water quality; bats; benthic resources; birds; coastal habitat and fauna; finfish, invertebrates, and essential fish habitat; sea turtles; wetlands; demographics, employment, and economics; land use and coastal infrastructure; navigation and vessel traffic; and recreation and tourism. Those resources with potential impact ratings greater than **moderate** are included in Chapter 3, *Affected Environment and Environmental Consequences,* of the Final EIS. Locating environmental resource sections with no greater than moderate adverse impacts in Appendix O supports the 300-page limits of the body of the EIS (40 CFR § 1502.7).

This page was intentionally left blank.

3.4 Physical Resources

3.4.1 Air Quality

This section discusses potential impacts on air quality from the proposed Project, alternatives, and ongoing and planned activities in the air quality geographic analysis area. The air quality geographic analysis area, as shown on Figure 3.4.1-1, includes the airshed within 25 miles (40 kilometers) of the Lease Area and the airshed within 15.5 miles (25 kilometers) of onshore construction areas and ports that may be used for the Project. The geographic analysis area encompasses the geographic region subject to USEPA review as part of an OCS permit for the Project under the Clean Air Act (CAA) (42 USC 7409). The geographic analysis area also considers potential air quality impacts associated with the onshore construction areas and the marshalling port(s) outside of the OCS permit area. Given the generally low emissions of the sea vessels and equipment that would be used during proposed construction activities, any potential air quality impacts would likely be within a few miles of the source. BOEM selected the 15.5-mile (25-kilometer) distance to provide a reasonable buffer.

3.4.1.1 Description of the Affected Environment

The geographic analysis area for air quality covers most of Rhode Island, southeastern Massachusetts eastward across Cape Cod, southward across Martha's Vineyard, and over the open ocean south and west of Martha's Vineyard. This includes the air above the Wind Farm Area and adjacent OCS area, the offshore export cable routes and onshore cable routes, the onshore converter stations/substations, the construction staging areas, the onshore construction and proposed Project-related sites, and the ports used to support proposed Project activities. COP Volume 2, Table A-1 (SouthCoast Wind 2024), provides further description of the air quality geographic analysis area. Appendix B, *Supplemental Information and Additional Figures and Tables*, provides information on climate and meteorological conditions in the Project area and vicinity.

Air quality within a region is measured in comparison to the National Ambient Air Quality Standards (NAAQS), which are standards established by USEPA pursuant to the CAA for several common pollutants, known as criteria pollutants, to protect human health and welfare. The criteria pollutants are carbon monoxide (CO), lead, nitrogen dioxide (NO_2), ozone, particulate matter 10 microns or less in diameter (PM_{10}), particulate matter 2.5 microns or less in diameter ($PM_{2.5}$), and sulfur dioxide (SO_2). Massachusetts has established ambient air quality standards (AAQS) that are similar to the NAAQS. Table 3.4.1-1 shows the NAAQS. Emissions of lead from Project-associated sources would be negligible because lead is not a component of liquid or gaseous fuels; accordingly, lead is not analyzed in this EIS. Ozone is not emitted directly but is formed in the atmosphere from precursor chemicals, primarily nitrogen oxides (NO_X) and volatile organic compounds (VOCs), in the presence of sunlight. Potential impacts of a project on ozone levels are evaluated in terms of NO_X and VOC emissions.

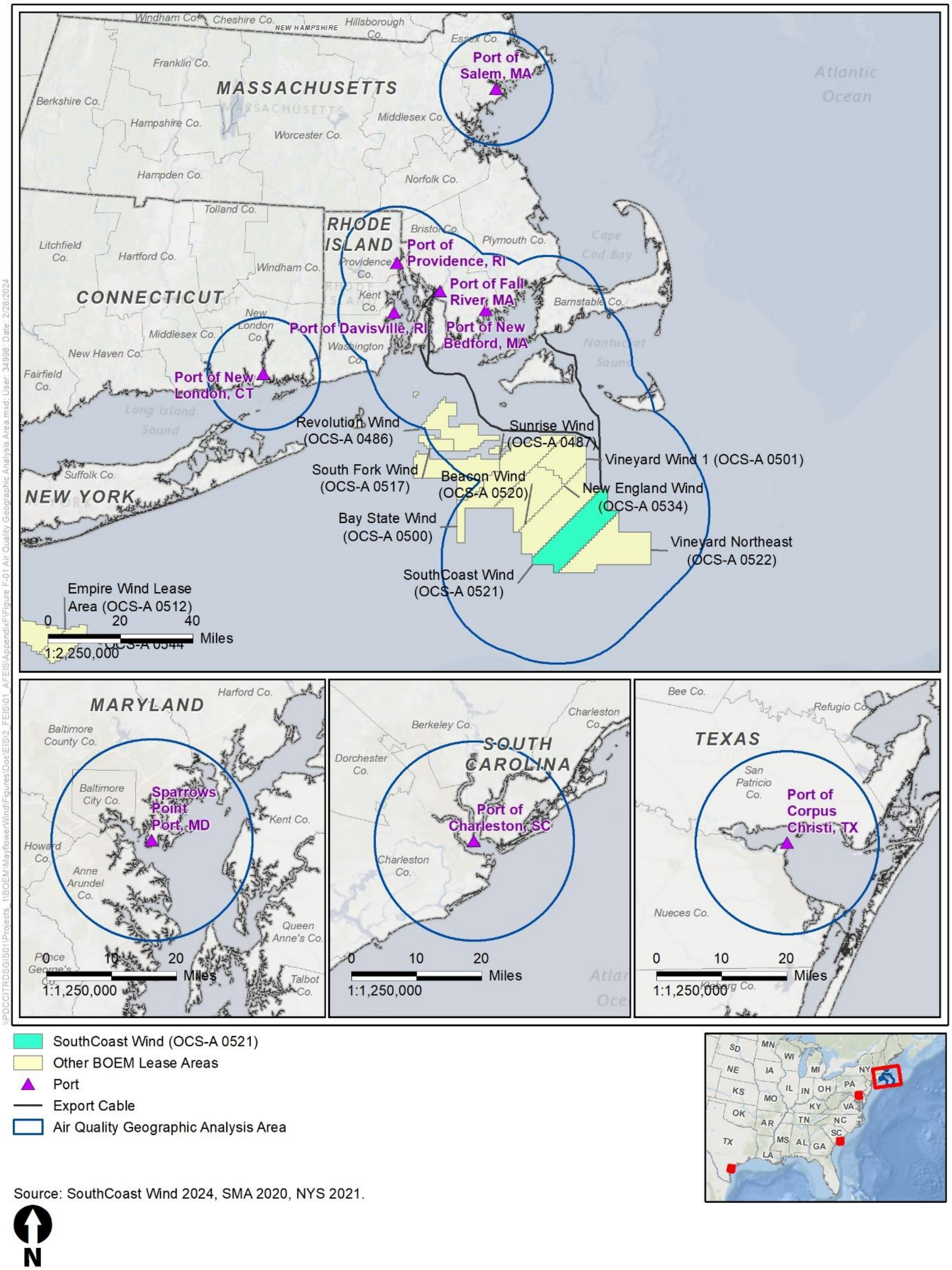


Figure 3.4.1-1. Air quality geographic analysis area

Table 3.4.1-1. National Ambient Air Quality Standards

Criteria Pollutant		Primary/ Secondary	Averaging Time	Level	Form of Standard
Carbon monoxide (CO)		Primary	8 hours	9 ppm	Not to be exceeded more than once per year
			1 hour	35 ppm	
Lead (Pb)		Primary and secondary	Rolling 3-month average	0.15 µg/m^3 [a]	Not to be exceeded
Nitrogen dioxide (NO_2)		Primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Primary and secondary	1 year	53 ppb [b]	Annual mean
Ozone (O_3)		Primary and secondary	8 hours	0.070 ppm [c]	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particle pollution (PM)	$PM_{2.5}$	Primary	1 year	9.0 µg/m^3	Annual mean, averaged over 3 years
		Secondary	1 year	15.0 µg/m^3	Annual mean, averaged over 3 years
		Primary and secondary	24 hours	35 µg/m^3	98th percentile, averaged over 3 years
	PM_{10}	Primary and secondary	24 hours	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur dioxide (SO_2)		Primary	1 hour	75 ppb [d]	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year

Source: 40 CFR 50.

[a] In areas designated nonattainment for the Pb standards prior to the promulgation of the current (2008) standards, and for which implementation plans to attain or maintain the current (2008) standards have not been submitted and approved, the previous standards (1.5 µg/m^3 as a calendar quarter average) also remain in effect.

[b] The level of the annual NO_2 standard is 0.053 ppm. It is shown here in terms of ppb for the purposes of clearer comparison to the 1-hour standard level.

[c] Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) O_3 standards are not revoked and remain in effect for designated areas. Additionally, some areas may have certain continuing implementation obligations under the prior revoked 1-hour (1979) and 8-hour (1997) O_3 standards.

[d] The previous SO_2 standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2)any area for which an implementation plan providing for attainment of the current (2010) standard has not been submitted and approved and which is designated nonattainment under the previous SO_2 standards or is not meeting the requirements of a SIP call under the previous SO_2 standards (40 CFR 50.4(3)). A SIP call is a USEPA action requiring a state to resubmit all or part of its State Implementation Plan to demonstrate attainment of the required NAAQS.

µg/m^3 = micrograms of pollutant per cubic meter of air; ppb = parts per billion; ppm = parts per million.

USEPA designates all areas of the country as being in attainment or nonattainment, or as unclassified for each criteria pollutant. An attainment area is an area where all criteria pollutant concentrations are within all NAAQS. A nonattainment area does not meet the NAAQS for one or more pollutants. Unclassified areas are those where attainment status cannot be determined based on available information and are regulated as attainment areas. An area can be in attainment for some pollutants and nonattainment for others. If an area was in nonattainment at any point in the last 20 years but is currently in attainment or is unclassified, then the area is designated a maintenance area.

Nonattainment and maintenance areas are required to prepare a State Implementation Plan, which describes the region's program to attain and maintain compliance with the NAAQS. The attainment status of an area can be found at 40 CFR 81 and in the USEPA Green Book, which the agency revises from time to time (USEPA 2021a). Attainment status is determined through evaluation of air quality data from a network of monitors.

All of southeastern Massachusetts is currently designated as unclassifiable or in attainment for all criteria pollutants, except for Dukes County on Martha's Vineyard, which is designated as marginally in nonattainment for the 2008 ozone NAAQS of 75 parts per billion (ppb). In August 2018, USEPA designated Dukes County as attainment for the current, more stringent 2015 ozone NAAQS of 70 ppb. Monitored ozone values in Dukes County have remained below the NAAQS of 70 ppb since 2018. However, the nonattainment designation for Dukes County for the 2008 ozone standard remains in effect. The entire state of Rhode Island is currently in attainment for all criteria pollutants.

SouthCoast Wind is considering multiple ports for construction including New Bedford, Fall River, and Salem, Massachusetts; Davisville and Providence, Rhode Island; New London, Connecticut; Sparrows Point, Maryland; Charleston, South Carolina; and Corpus Christi, Texas as well as some international ports. Project components may be delivered from international ports including ports in Mexico (Altamira), Canada (Sheet Harbor, Sydney, Argentia), and Europe and Asia. O&M vessel trips would originate primarily from the ports of New Bedford and Fall River, Massachusetts; New London, Connecticut; or Providence, Rhode Island, with the potential for occasional repair and supply delivery trips originating from ports in Davisville and Providence, Rhode Island; Salem, Massachusetts; Sparrows Point, Maryland; and Charleston, South Carolina.

The attainment status of these ports varies. The potential ports in the New England region are in attainment areas except for the Port of New London, Connecticut, which is in a nonattainment area for the ozone NAAQS. Sparrows Point, Maryland is in nonattainment areas for the SO_2 and ozone NAAQS. Charleston, South Carolina and Corpus Christi, Texas are in attainment areas. Figure 3.4.1-1 shows the locations of all these ports.

The CAA prohibits federal agencies from approving any activity that does not conform to a State Implementation Plan. This prohibition applies only with respect to nonattainment or maintenance areas (i.e., areas that were previously in nonattainment and for which a maintenance plan is required). Conformity to a State Implementation Plan means conformity to a State Implementation Plan's purpose of reducing the severity and number of violations of the NAAQS to achieve attainment of such standards. The activities for which BOEM has authority are outside of any nonattainment or maintenance area and, therefore, not subject to the requirement to show conformity.

The CAA defines Class I areas as certain national parks and wilderness areas where very little degradation of air quality is allowed. Class I areas consist of national parks larger than 6,000 acres and wilderness areas larger than 5,000 acres that were in existence before August 1977. Projects subject to federal permits are required to notify the federal land manager responsible for designated Class I areas within 62 miles (100 kilometers) of a Project[1] (USEPA 1992). The federal land manager identifies appropriate air quality–related values for the Class I area and evaluates the impact of the Project on air quality–related values. Air quality–related values identified by the federal land manager for a particular Class I area may include criteria pollutants, visibility, and acidic deposition. The nearest Class I area is the Lye Brook Wilderness, Vermont, which is approximately 130 miles (210 kilometers) from the nearest Project component (the Brayton Point HVDC Converter Stations, which are nearer to the Lye Brook Wilderness than is the Wind Farm Area). This distance is greater than the 100-kilometer distance within which USEPA recommends that the federal land manager of the Class I area be notified about a project that requires a federal air quality permit.

The CAA amendments directed USEPA to establish requirements to control air pollution from OCS oil- and gas-related activities along the Pacific, Arctic, and Atlantic Coasts and along the U.S. Gulf Coast off of Florida, east of 87° 30′ west longitude. The OCS Air Regulations (40 CFR 55) establish the applicable air pollution control requirements, including provisions related to permitting, monitoring, reporting, fees, compliance, and enforcement for facilities subject to the CAA. These regulations apply to OCS sources that are beyond state seaward boundaries. Projects within 25 nm of a state seaward boundary are required to comply with the air quality requirements of the nearest or corresponding onshore area, including applicable permitting requirements.

3.4.1.2 Impact Level Definitions for Air Quality

Definitions of potential impact levels are provided in Table 3.4.1-2. Impact levels are intended to serve NEPA purposes only, and they are not intended to establish thresholds or other requirements with respect to permitting under the CAA.

Table 3.4.1-2. Impact level definitions for air quality

Impact Level	Type of Impact	Definition
Negligible	Adverse	Increases in ambient pollutant concentrations due to Project emissions would not be detectable.
	Beneficial	Decreases in ambient pollutant concentrations due to Project emissions would not be detectable.
Minor to Moderate	Adverse	Increases in ambient pollutant concentrations due to Project emissions would be detectable but would not lead to violation of the NAAQS.
	Beneficial	Decreases in ambient pollutant concentrations due to Project emissions would be detectable.
Major	Adverse	Increases in ambient pollutant concentrations due to Project emissions could cause or contribute to violation of the NAAQS.
	Beneficial	Decreases in ambient pollutant concentrations due to Project emissions would be larger than for minor to moderate impacts.

[1] The 100-kilometer distance applies to notification and is not a threshold for use in evaluating impacts. Impacts at Class I areas at distances greater than 100 kilometers may need to be considered for larger emission sources if there is reason to believe that such sources could affect the air quality in the Class I area (USEPA 1992).

3.4.1.3 Impacts of Alternative A – No Action on Air Quality

When analyzing the impacts of the No Action Alternative on air quality, BOEM considered the impacts of ongoing activities, including ongoing non-offshore wind and ongoing offshore wind activities on the baseline conditions for air quality. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities, as described in Appendix D, *Planned Activities Scenario*.

Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for air quality described in Section 3.4.1.1, *Description of the Affected Environment and Future Baseline Conditions* would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities. Ongoing non-offshore wind activities within the geographic analysis area that contribute to impacts on air quality are generally associated with onshore impacts, including residential, commercial, industrial, and transportation activities as well as construction. These activities and associated impacts are expected to continue at current trends and have the potential to affect air quality through their emissions. Impacts associated with climate change could affect ambient air quality through increased formation of ozone and particulate matter associated with increasing air temperatures.

Ongoing offshore wind activities within the geographic analysis area that contribute to impacts on air quality include ongoing construction of the Vineyard Wind 1 project (62 WTGs and 1 OSP) in OCS-A 0501, the South Fork project (12 WTGs and 1 OSP) in OCS-A 0517, and the Revolution Wind project (65 WTGs and two OSPs) in OCS-A 0486. Ongoing construction of the Vineyard Wind 1, South Fork, and Revolution Wind projects would have the same type of impacts on air quality that are described in *Cumulative Impacts of the No Action Alternative* for all ongoing and planned offshore wind activities in the geographic analysis area but would be of lower intensity.

Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative in combination with other planned non-offshore wind activities and planned offshore wind activities (without the Proposed Action). The Massachusetts Global Warming Solutions Act of 2008 sets out a series of requirements for how the state is to achieve GHG emissions reductions by mid-century. One of the requirements is for the state to set an emissions limit for 2030 and develop an implementation plan to achieve that limit. Massachusetts has set its GHG emissions reduction target for the next decade at a 45 percent reduction below the 1990 level in 2030. The Massachusetts Clean Energy and Climate Plan for 2025 and 2030 establishes a blueprint for achieving this limit equitably and affordably, with major new initiatives advancing decarbonization of the Commonwealth's buildings, transportation, and electricity sectors (EEA 2022). Similarly, Rhode Island EO 20-01 of 2020 set a goal to meet 100 percent of Rhode Island's electricity demand with renewable energy by 2030. The Rhode Island State Energy Plan demonstrates that Rhode Island can increase sector fuel diversity, produce net economic benefits, and reduce GHG emissions by 45 percent by the year 2035. The plan proposes advanced policies and strategies to achieve those goals (OER 2015).

Impacts from fossil-fueled power facilities are expected to be mitigated partially by implementation of other offshore wind projects near the geographic analysis area, including in the regions off New England, New York, New Jersey, Delaware, and Maryland to the extent that these wind projects would result in a reduction in emissions from fossil-fueled power facilities. Other planned activities that could contribute to air quality impacts include construction of undersea transmission lines, gas pipelines, and other submarine cables; marine minerals use and ocean-dredged material disposal; military use; marine transportation; oil and gas activities; and onshore development activities (see Appendix D, Section D.2 for a complete description of planned activities).

The sections below summarize the potential impacts of ongoing and planned offshore wind activities (other than the Proposed Action) on air quality during construction, O&M, and decommissioning of the projects. The air quality geographic analysis area overlaps with most, but not all, of the offshore wind lease areas in the Massachusetts and Rhode Island region (Figure 3.4.1-1). BOEM conservatively assumed in its analysis of air quality impacts that all 901 WTGs estimated for the Massachusetts/Rhode Island region (except for the Proposed Action) associated with OCS-A-0486, OCS-A-0487, OCS-A-0500, OCS-A 0501, OCS-A 0517, OCS-A-0520, OCS-A 0522, OCS-A 0534 would be sited within the air quality geographic analysis area (Appendix D, Table D2-1).

BOEM expects offshore wind activities to affect air quality through the following primary IPFs.

Air emissions: Most air pollutant emissions and air quality impacts from offshore wind projects would occur during construction, potentially from multiple projects occurring simultaneously. Construction activity would occur at different locations and could overlap temporally with activities at other locations, including operational activities at previously constructed projects. All projects would be required to comply with the CAA. Primary emissions sources would include increased public and commercial vehicular traffic, air traffic, combustion emissions from construction equipment, and fugitive emissions from construction-generated dust. During operations, emissions from future offshore wind projects in the air quality geographic analysis area would overlap temporally, but operations would contribute few criteria pollutant emissions compared to construction and decommissioning. Operational emissions would result largely from commercial vessel traffic and emergency diesel generators. The aggregate operational emissions for all projects in the air quality geographic analysis area would vary by year as successive projects begin operation. As wind energy projects come online, power-generation emissions overall could decrease and the region as a whole could realize a net benefit to air quality.

The offshore wind projects other than the Proposed Action that may result in air pollutant emissions and air quality impacts in the air quality geographic analysis area include projects within all or portions of the following lease areas: OCS-A-0486, OCS-A-0487, OCS-A-0500, OCS-A 0501, OCS-A 0517, OCS-A-0520, OCS-A 0522, OCS-A 0534 (Appendix D, Table D2-4). If fully developed, projects proposed in these lease areas would produce 14 GW of renewable power from the installation of 901 WTGs (Appendix D, Table

D2-1). Based on the assumed offshore construction schedule in Table D2-1, the projects in the geographic analysis area would be in construction between 2023 and 2031.

During the construction phase, the total emissions of criteria pollutants and ozone precursors from offshore wind projects other than SouthCoast Wind proposed within the air quality geographic analysis area, summed over all construction years, are estimated to be 34,496 tons of CO, 165,807 tons of NO_X, 8,808 tons of PM_{10}, 5,589 tons of $PM_{2.5}$, 4,441 tons of SO_2, 5,732 tons of VOCs, and 11,228,498 tons of carbon dioxide (CO_2) (Appendix D, Table D2-4). Most emissions would occur from diesel-fueled construction equipment, vessels, and commercial vehicles. The magnitude of the emissions and the resulting air quality impacts would vary spatially and temporally during the construction phases. Construction activity would occur at different locations and could overlap temporally with activities at other locations, including operational activities at previously constructed projects. As a result, air quality impacts would be minor, shifting spatially and temporally across the geographic analysis area.

During operations, emissions from offshore wind projects in the geographic analysis area would overlap temporally, but operations would contribute few criteria pollutant emissions compared to construction and decommissioning. Operational emissions would come largely from commercial vessel traffic and emergency diesel generators. The aggregate operational emissions for all projects in the analysis area would vary by year as successive projects begin operation. Estimated operational emissions would be 1,297 tons per year of CO, 5,073 tons per year of NO_X, 152 tons per year of PM_{10}, 137 tons per year of $PM_{2.5}$, 75 tons per year of SO_2, 100 tons per year of VOCs, and 412,263 tons per year of CO_2 (Appendix D, Table D2-4). Operational emissions would result in negligible air quality impacts because emissions would be intermittent, localized, and dispersed throughout the combined lease areas and vessel routes from the onshore O&M facility.

Offshore wind energy development could help displace emissions from fossil fuels, potentially improving regional air quality and reducing GHG emissions. An analysis by Barthelmie and Pryor (2021) calculated that, depending on global trends in GHG emissions and the amount of wind energy expansion, development of wind energy could reduce predicted increases in global surface temperature by 0.3 to 0.8 degrees Celsius (°C) (0.5–1.4 degrees Fahrenheit [°F]) by 2100. The displacement of fossil fuels by wind energy is highly influenced by how individual power plants respond to the introduction of wind energy. For example, the process of changing the plant's output may temporarily increase the plant's emissions (Katzenstein and Apt 2009).[2]

Estimations and evaluations of potential health and climate benefits from offshore wind activities for specific regions and project sizes rely on information about the air pollutant emissions contributions of

---

[2] Katzenstein and Apt (2009) modeled a system of two types of natural gas generators, four wind farms, and one solar farm. The power output of wind and solar facilities can vary relatively rapidly as meteorological conditions change, and the natural gas generators vary their power output accordingly to meet electrical demand. When gas generators change their power output their emissions rates may increase above their steady-state levels. As a result, the net emissions reductions realized from gas generators reducing their output in response to wind and solar power can be less than the reduction that would be expected based solely on the amount of wind and solar power. The study found that reductions in CO_2 emissions would be about 80 percent, and in NO_X emissions about 30 to 50 percent, of the emissions reductions expected if the power fluctuations caused no additional emissions.

the existing and projected mixes of power generation sources, and generally estimate the annual health benefits of an individual commercial scale offshore wind project to be valued in the hundreds of millions of dollars (Kempton et al. 2005; Buonocore et al. 2016).

The potential health benefits of avoided emissions can be evaluated using USEPA's CO-Benefits Risk Assessment (COBRA) health impacts screening and mapping tool (USEPA 2020a). COBRA is a tool that estimates the health and economic benefits of clean energy policies. COBRA was used to analyze the avoided emissions that were calculated for development of 36 GW of reasonably foreseeable wind power on the OCS from ongoing and planned offshore wind projects (Appendix D, Table D2-1). Table 3.4.1-3 presents the estimated monetized health benefits and avoided mortality for this scenario.

Table 3.4.1-3. COBRA estimate of annual avoided health effects with 36 GW reasonably foreseeable offshore wind power

Discount Rate [a] (2023)	Monetized Total Health Benefits (million U.S. dollars/year)		Avoided Mortality (cases/year)	
	Low Estimate [b]	High Estimate [b]	Low Estimate [b]	High Estimate [b]
3%	$232	$523	21	47
7%	$203	$460	21	47

Source: USEPA 2020a.
[a] The discount rate is used to express future economic values in present terms. Not all health effects and associated economic values occur in the year of analysis. Therefore, COBRA accounts for the "time value of money" preference (i.e., a general preference for receiving economic benefits now rather than later) by discounting benefits received later (USEPA 2020b).
[b] The low and high estimates are derived using two sets of assumptions about the sensitivity of adult mortality and non-fatal heart attacks to changes in ambient $PM_{2.5}$ levels. Specifically, the high estimates are based on studies that estimated a larger effect of changes in ambient $PM_{2.5}$ levels on the incidence of these health effects (USEPA 2020b).

BOEM anticipates that the air quality impacts associated with offshore wind activities other than the Proposed Action in the geographic analysis area would result in minor adverse impacts due to emissions of criteria pollutants, VOCs, air toxics or hazardous air pollutants (HAPs), and GHGs, mostly released during construction and decommissioning. Impacts would be minor because these emissions would incrementally increase ambient pollutant concentrations, though not by enough to cause a violation of the NAAQS or Massachusetts AAQS. Offshore wind projects likely would lead to reduced emissions from fossil-fueled power facilities and consequently minor to moderate beneficial impacts on air quality.

Accidental releases: Offshore wind activities could release VOCs and HAPs because of accidental chemical spills in the geographic analysis area. Section 3.4.2, *Water Quality*, discusses the nature of releases anticipated. Based on Appendix D, Table D2-3, up to about 1,833,481 gallons (6.9 million liters) of coolants, 6,835,448 gallons (25.9 million liters) of oils and lubricants, and 1,729,064 gallons (6.5 million liters) of diesel fuel would be contained in the 920 wind turbine and substation structures for the wind energy projects in the geographic analysis area. If accidental releases occur, they would be most likely during construction but could occur during operation and decommissioning of offshore wind facilities. These may lead to short-term periods (hours to days)[3] of HAP emissions through surface

[3] For example, small diesel fuel spills (500–5,000 gallons) usually will evaporate and disperse within a day or less (NOAA 2006).

evaporation. HAP emissions would consist of VOCs, which may be important for ozone formation. By comparison, the smallest tanker vessel operating in these waters (a general-purpose tanker) has a capacity of between 3.2 and 8 million gallons (12.1 million and 30.3 million liters). Tankers are relatively common in these waters, and the total WTG chemical storage capacity in the geographic analysis area is much less than the volume of hazardous liquids transported by ongoing activities (U.S. Energy Information Administration 2014). BOEM expects air quality impacts from accidental releases would be negligible because impacts would be short term and limited to the area near the accidental release location. Accidental spills would occur infrequently over a 33-year period with a higher probability of spills during future project construction, but they would not be expected to contribute appreciably to overall impacts on air quality.[4]

Conclusions

Impacts of the No Action Alternative: Under the No Action Alternative, air quality would continue to reflect current regional trends and respond to IPFs introduced by other ongoing activities. Additional, higher-emitting, fossil-fueled power facilities could be built, or could be kept in service, to meet future power demand, fired by natural gas, oil, or coal. These impacts would be partially mitigated once the approved Vineyard Wind 1, South Fork, and Revolution Wind offshore wind projects are operational. BOEM expects ongoing non-offshore wind activities and offshore wind activities to have continuing regional air quality impacts primarily through air pollutant emissions, accidental releases, and climate change. BOEM anticipates that the impacts of ongoing activities, such as air pollutant emissions and GHGs, would be **minor to moderate adverse**.

Cumulative Impacts of the No Action Alternative: Under the No Action Alternative, existing environmental trends and ongoing activities would continue to affect air quality in the geographic analysis area. Planned non-offshore wind activities would contribute to impacts on air quality because air pollutant and GHG emissions would increase through construction and operation of new energy generation facilities to meet future power demands. Although there are no such energy generation facilities planned to occur in the geographic analysis area, continuation of current regional trends in energy development could include new power plants that could contribute to air quality and GHG impacts in Massachusetts and the other New England states.

Planned and ongoing offshore wind activities would contribute to air quality impacts due to emissions of criteria pollutants, VOCs, HAPs, and GHGs, mostly released during construction and decommissioning. Impacts would be minor because these emissions would incrementally increase ambient pollutant concentrations, though not by enough to cause a violation of the NAAQS or Massachusetts AAQS.

---

[4] SouthCoast Wind's lease with BOEM (Lease OCS-A 0521) has an operational term of 33 years that commences on the date of COP approval (BOEM 2019); see also 30 CFR 585.235(a)(3)). SouthCoast Wind would need to request an extension of its operational term from BOEM to operate the proposed Projects for 35 years. For the purposes of maximum-case scenario and to ensure NEPA coverage if BOEM grants such an extension, the Final EIS analyzes a 35-year operational term for all resource impact analyses except for air quality. The air quality impact analysis assumes a 33-year operational term to provide a conservative assessment of emissions offsets during the operational term of the Proposed Action.

Pollutant emissions during operations would be generally lower and more transient. Most air pollutant emissions and air quality impacts would occur during multiple overlapping project construction phases from 2023 through 2030. Once operational, offshore wind projects likely would lead to beneficial impacts on air quality through reduced emissions from fossil-fueled power facilities.

Overall, BOEM anticipates the cumulative impacts of the No Action Alternative on air quality from ongoing and planned activities would be **minor to moderate adverse**, largely driven by emissions from fossil-fueled power facilities, other ongoing and planned non-offshore wind emissions, and emissions from construction and decommissioning of offshore wind projects. Because offshore wind projects likely would lead to reduced emissions from fossil-fueled power facilities, BOEM also anticipates the cumulative impacts of the No Action Alternative would result in **minor** to **moderate beneficial** impacts on regional air quality.

Construction and operation of offshore wind projects would produce GHG emissions that would contribute incrementally to climate change. CO_2 is relatively stable in the atmosphere and, for the most part, mixed uniformly throughout the troposphere and stratosphere. As such, the impact of GHG emissions does not depend on the source location. Increasing energy production from offshore wind projects would likely reduce regional GHG emissions by displacing energy from fossil fuels. This reduction would more than offset the relatively small GHG emissions from offshore wind projects. Regional reductions in GHG emissions would support states in meeting their renewable energy and emissions goals and would reinforce ongoing trends toward electrifying transportation and heating, as the climate benefits of electrification of these sectors depend on renewable electricity as a lower-emissions source of energy than fossil fuels. In all, the reduction in regional GHG emissions would be noticeable in the regional context, would contribute incrementally to reducing climate change, and would represent a moderate beneficial impact in the regional context but a negligible beneficial impact in the global context.

3.4.1.4 Relevant Design Parameters and Potential Variances in Impacts

This EIS analyzes the maximum-case scenario; any potential variances in the proposed Project build-out as defined in the PDE would result in impacts similar to or less than those described in the following sections. The following PDE parameters (Appendix C, *Project Design Envelope and Maximum-Case Scenario*) would influence the magnitude of the impacts on air quality.

- Emissions ratings of construction equipment and vehicle engines.
- Location of construction laydown areas.
- Choice of cable-laying locations and pathways.
- Choice of marine traffic routes to and from the Wind Farm Area and offshore export cable routes.
- Soil characteristics at excavation areas, which may affect fugitive emissions.
- Emissions control strategy for fugitive emissions due to excavation and hauling operations.

Changes to the design capacity of the WTGs would not alter the maximum potential air quality impacts for the proposed Project and alternatives because the maximum-case scenario involves the maximum number of WTGs (147) allowed in the PDE.

SouthCoast Wind has committed to measures to minimize impacts on air quality. Low sulfur fuels would be used to the extent practicable. Low-NO_X engines designed to reduce air pollution would be used when practicable. SouthCoast Wind would implement an onshore construction schedule to minimize effects on neighboring land uses to the extent feasible. Best management practices would be implemented throughout the Project phases to reduce potential air quality effects. Impacts from accidental releases would be reduced through implementation of a Stormwater Pollution Prevention Plan (SWPPP) and a Spill Prevention, Control, and Countermeasure Plan. The SWPPP also would include measures to control fugitive dust that may be generated as a result of soil disturbance and construction vehicle traffic (COP Volume 2, Table 16-1; SouthCoast Wind 2024).

3.4.1.5 Impacts of Alternative B - Proposed Action on Air Quality

The Proposed Action may generate emissions and affect air quality in the Massachusetts region and nearby coastal waters during construction, O&M, and decommissioning activities. Onshore emissions would occur in the onshore export cable corridors and at points of interconnection, potentially including the Falmouth Tap substation in Falmouth, Massachusetts, and the National Grid substation at Brayton Point in Somerset, Massachusetts.[5] Offshore emissions would be within the OCS, including state offshore waters. Offshore emissions would occur in the Lease Area and the offshore export cable corridors. COP Volume 1, Section 3.3 (SouthCoast Wind 2024) provides additional information on land use and proposed ports.

Air quality in the geographic analysis area may be affected by emissions of criteria pollutants from sources involved in the construction or maintenance of the Proposed Action and, potentially, during operations. These impacts, while generally localized to the areas near the emissions sources, may occur at any location associated with the Proposed Action, be it offshore in the Wind Farm Area or at any of the onshore construction or support sites. Ozone levels in the region also could be affected.

The Proposed Action's WTGs, substations, and offshore and onshore cable corridors would not themselves generate air pollutant emissions during normal operations. However, air pollutant emissions from equipment used in the construction, O&M, and decommissioning phases could affect air quality in the geographic analysis area and nearby coastal waters and shore areas. Most emissions would occur temporarily during construction, offshore in the Wind Farm Area, onshore at the landfall sites, along the offshore and onshore export cable routes, at the onshore substation and converter station sites, and at the construction staging areas. Additional emissions related to the Proposed Action could also occur at the ports used to transport material and personnel to and from the Project area. However, the Proposed Action would provide beneficial impacts on air quality in the vicinity of the Project and the surrounding

[5] As described in Chapter 2, Section 2.1.2, *Alternative B – Proposed Action,* Brayton Point is the preferred ECC for both Project 1 and Project 2, and Falmouth is the variant ECC for Project 2, which would be used if SouthCoast Wind is prevented from using Brayton Point for Project 2.

region to the extent that energy produced by the Proposed Action would displace energy produced by fossil-fueled power facilities.

The majority of air pollutant and GHG emissions from the Proposed Action alone would come from the main engines, auxiliary engines, and auxiliary equipment on marine vessels used during offshore construction activities. Fugitive dust emissions would occur as a result of excavation and hauling of soil during onshore construction activities. Emissions from the OCS source, as defined in the CAA, would be permitted as part of SouthCoast Wind's OCS permit.

The emissions estimates in this section do not include emissions from raw material extraction, material processing, and component manufacturing, i.e., a full life-cycle analysis. However, recently published studies have analyzed the life-cycle impacts of offshore wind (Ferraz de Paula and Carmo 2022; Rueda-Bayona et al. 2022; Shoaib 2022). These studies concluded that the materials having the greatest impact on life-cycle emissions generally are steel and concrete and that material recycling rates have a large influence on life-cycle emissions. The National Renewable Energy Laboratory harmonized approximately 3,000 life cycle assessment studies with around 240 published life-cycle analyses of land-based and offshore wind technologies (NREL 2021). Though wind has higher upstream emissions than many other generation methods, its life-cycle GHG emissions are orders of magnitude lower. NREL (2021) estimated that the central 50 percent of GHG estimates reviewed were in the range of 9.4–14 grams of CO_2e per kilowatt-hour (g CO_2-eq/kWh) while life-cycle GHG estimates for coal and natural gas are on the scale of 1,000 g CO_2-eq/kWh (Dolan and Heath 2012) and 480 g CO_2-eq/kWh (O'Donoughue 2014), respectively.

Air Emissions – Construction

Fuel combustion, earthmoving, and solvent use would cause construction-related emissions. The air pollutants would include criteria pollutants, VOCs, HAPs, and GHGs. During the construction phase, the activities of additional workers, increased traffic congestion, additional commuting miles for construction personnel, and increased air-polluting activities of supporting businesses also could have impacts on air quality. Construction equipment would comply with all applicable fuel-efficiency, fuel sulfur content, and emissions standards to minimize combustion emissions and associated air quality impacts. The total estimated construction emissions of each pollutant are summarized in Table 3.4.1-4. BOEM anticipates that air quality impacts from construction of the Proposed Action would be minor.

Table 3.4.1-4. SouthCoast Wind total construction emissions (criteria pollutants and VOCs in U.S. tons; GHGs in metric tons)

Year [a]	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC	CO_2	CH_4	N_2O	CO_2e
2025	1,183	5,709	414	224	222	227	337,863	1.7	12.7	341,282
2026	1,183	5,709	414	224	222	227	337,863	1.7	12.7	341,282
2027	1,183	5,709	414	224	222	227	337,863	1.7	12.7	341,282
2028	1,183	5,709	414	224	222	227	337,863	1.7	12.7	341,282
2029	1,183	5,709	414	224	222	227	337,863	1.7	12.7	341,282
2030	1,183	5,709	414	224	222	227	337,863	1.7	12.7	341,282

Year [a]	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC	CO_2	CH_4	N_2O	CO_2e
2031	1,183	5,709	414	224	222	227	337,863	1.7	12.7	341,282
Total	8,284	39,964	2,897	1,566	1,556	1,589	2,365,042	12	89	2,388,972

Source: COP, Appendix G, Table 5-1; SouthCoast Wind 2024.
Sum of individual values may not equal total due to rounding.
[a] SouthCoast Wind has revised its construction schedule to 7 years from 4 years; however, SouthCoast Wind COP Appendix G (the source for the emissions data in Table 3.4.1-4) reflects 4 years of construction emissions. BOEM expects that total construction emissions over a 7-year period, as shown in the table, would be similar to the totals shown in COP Appendix G, but that maximum annual emissions would be less than in COP Appendix G because construction would be spread out over 7 years instead of 4.

Offshore Construction

Emissions from potential construction activities would vary throughout the construction and installation of offshore components. Emissions from offshore activities would occur during pile driving and scour-protection installation, offshore cable laying, turbine installation, and substation installation. Offshore construction-related emissions also would come from diesel-fueled generators used to temporarily supply power to the WTGs and substations so that workers could operate lights, controls, and other equipment before cabling is in place. There also would be emissions from engines used to power pile-driving hammers and air compressors used to supply compressed air to noise-mitigation devices during pile driving (if used). Emissions from vessels used to transport workers, supplies, and equipment to and from the construction areas would result in additional air quality impacts. The Proposed Action may need emergency generators at times, potentially resulting in increased emissions for limited periods. SouthCoast Wind has proposed measures to reduce emissions including compliance with applicable fuel-efficiency, fuel sulfur content, and emissions standards (COP Volume 2, Table 16-1; SouthCoast Wind 2024).

The majority of air pollutant and GHG emissions from the Proposed Action alone would come from the main engines, auxiliary engines, and auxiliary equipment on marine vessels used during offshore construction activities. Fugitive dust emissions would occur as a result of excavation and hauling of soil during onshore construction activities. Emissions from the OCS source, as defined in the CAA, would be permitted as part of the OCS permit for which SouthCoast Wind is currently in the application process. The Project must demonstrate compliance with the NAAQS. The OCS air permitting process includes air dispersion modeling of emissions to demonstrate compliance with the NAAQS. The CAA also provides protection of air quality in Class I wilderness areas by means of the NAAQS and the Prevention of Significant Deterioration (PSD) program and gives federal land managers a responsibility to protect the air quality–related values of Class I areas from the adverse impacts of air pollution. If emissions from the Project would cause or contribute to adverse impacts on the air quality–related values of a Class I area, the permitting authority (i.e., USEPA) can deny the permit. As part of the air quality–related values analysis, the Project must demonstrate that significant visibility degradation would not occur.

NAAQS and PSD Dispersion Modeling

As part of the *SouthCoast Wind Outer Continental Shelf Air Permit Application* (OCS Application) (SouthCoast Wind 2023), SouthCoast Wind conducted dispersion modeling to demonstrate that construction of the Proposed Action will show modeled compliance with the NAAQS and PSD increments. Construction activities were divided among 11 scenarios (e.g., Seabed Prep/Scour Protection), which were selected based on consideration of the locations in which they are expected to occur as well as the likelihood that activities could take place simultaneously. The OCS Application, *Appendix C – OCS Permit Air Quality Modeling Report*, Section 4.4, *Modeling Scenarios* (SouthCoast Wind 2023), provides further description of the air quality modeling scenarios.

For the purposes of modeling, it was assumed that the worst-case year (resulting in the highest air emissions) will include up to 85 potential WTGs constructed and 1 OSP constructed within that year. Short-term construction modeling assumed all construction scenarios except OSP installation occurring simultaneously during a single day in the Lease Area but at separate/adjacent WTG locations. The overlap of impacts from an adjacent WTG location was accounted for by adding a representative concentration from another scenario (SouthCoast Wind 2023: Appendix C, Section 4.0).

Dispersion modeling was conducted in accordance with USEPA's *Guideline on Air Quality Models*, which is contained in 40 CFR Part 51, Appendix W, *Guidance for Ozone and Fine Particulate Matter Permit Modeling*, and MassDEP's *Modeling Guidance for Significant Stationary Sources of Air Pollution* (SouthCoast Wind 2023: Appendix C, Section 4.0). The USEPA's AERMOD-AERCOARE model was used to estimate criteria pollutant concentrations for comparison to the NAAQS and PSD increments (SouthCoast Wind 2023: Appendix C, Section 4.2). Three years (2018–2020) of Weather Research and Forecasting prognostic model data obtained from USEPA were selected for use in developing the overwater data required by AERCOARE. The Mesoscale Model Interface Program (MMIF–Version 4.0) was used to extract the meteorological data from a grid point located nearest to the Lease Area centroid (SouthCoast Wind 2023: Appendix C, Section 4.3). Emissions of secondary pollutants (particulate matter and ozone formed in the atmosphere from reactions of precursor chemicals) were estimated using USEPA's *Guidance on the Development of Modeled Emission Rates for Precursors as a Tier 1 Demonstration Tool for Ozone and PM2.5 under the PSD Permitting Program* (SouthCoast Wind 2023: Appendix C, Section 4.10).

Table 3.4.1-5 and Table 3.4.1-6 present a summary of model results for comparison to the NAAQS and PSD increments, respectively. The maximum modeled impact includes the contribution from nearby simultaneous-emissions scenarios where applicable. As shown in the tables, all pollutants and averaging periods are less than the NAAQS and PSD increments.

Table 3.4.1-5. Estimated pollutant concentrations during construction compared to NAAQS

Pollutant	Averaging Period	Rank [a]	Modeled Design Conc. [b] (µg/m^3)	Background Conc. (µg/m^3)	Total Conc. (µg/m^3)	NAAQS (µg/m^3)	% of NAAQS
CO	1-hour	H2H	3,085	1,803	4,888	40,000	12%
CO	8-hour	H2H	1,799	1,146	2,945	10,000	29%
NO_2	1-hour	98th %ile	183.1	Included [c]	183.1	188	97%
NO_2	Annual	Max	15.5	12.38	19.4	100	19%
PM_{10}	24-hour	H2H	12.6	26	38.6	150	26%

Pollutant	Averaging Period	Rank [a]	Modeled Design Conc. [b] (μg/m^3)	Background Conc. (μg/m^3)	Total Conc. (μg/m^3)	NAAQS (μg/m^3)	% of NAAQS
$PM_{2.5}$	24-hour	98th %ile	5.73 [d]	16.2	21.9	35	63%
$PM_{2.5}$	Annual	Max	0.69 [d]	6.61	7.30	12	61%
SO_2	1-hour	99th %ile	74.4	7.86	82.3	196	42%

Source: SouthCoast Wind 2023, Appendix C – OCS Permit Air Quality Modeling Report, Table 5-3.
[a] H2H = highest second-highest, 98th %ile = 98th percentile, 99th %ile = 99th percentile, Max = Maximum annual concentration.
[b] Maximum modeled design concentration over all construction scenarios. Contributions from nearby simultaneous scenarios are included, where applicable.
[c] Seasonal and hourly varying background concentrations were included directly in AERMOD.
[d] Includes $PM_{2.5}$ secondary concentration.
μg/m^3 = micrograms of pollutant per cubic meter of air; Conc. =Concentration.

Table 3.4.1-6. Estimated pollutant concentrations during construction compared to Prevention of Significant Deterioration increments

Pollutant	Averaging Period	Rank [a]	Modeled Design Concentration [b] (μg/m^3)	PSD Increment (μg/m^3)	% of PSD Increment
NO_2	Annual	Max	15.5	25	62%
PM_{10}	24-hour	H2H	12.6	30	42%
$PM_{2.5}$	24-hour	H2H	8.6[c]	9	96%
$PM_{2.5}$	Annual	Max	0.69[c]	4	17%
SO_2	3-hour	H2H	76.1	512	15%
SO_2	24-hour	H2H	30.3	91	33%

Source: SouthCoast Wind 2023, Appendix C – OCS Permit Air Quality Modeling Report, Table 5-5.
[a] H2H = highest second-highest, Max = Maximum annual concentration.
[b] Maximum modeled design concentration over all construction scenarios. Contributions from nearby simultaneous scenarios are included, where applicable.
[c] Includes $PM_{2.5}$ secondary concentration.
μg/m^3 = micrograms of pollutant per cubic meter of air.

Class 1 Wilderness Area Dispersion Modeling

Potential SouthCoast Wind Project impacts at Lye Brook Wilderness (Class 1 area) were estimated by scaling impacts at the same location presented by the nearby Vineyard Wind 1 project as a supplemental analysis to their OCS air permit application. Impacts for 24-hour PM_{10}, 24-hour $PM_{2.5}$, and annual NO_2 reported by Vineyard Wind 1 were scaled proportionally according to the ratio of SouthCoast Wind emissions to Vineyard Wind 1 emissions (and PSD increments) (SouthCoast Wind 2023: Appendix C, Section 5.4.1). The SouthCoast Wind emissions were based on the worst-case annual construction emissions for Project 1, as shown in Table 3-1 of Appendix C of the SouthCoast Wind OCS Permit Application (SouthCoast Wind 2023). The worst-case annual construction emissions include activities related to a buildout of up to 84 WTGs and one OSP in one year (for Project 1). As shown in Table 3.4.1-7, the estimated impacts due to the SouthCoast Wind Project are less than the USEPA Class I significant impact levels (SILs). USEPA considers that no further analysis is necessary for impacts that are less than the SILs.

Table 3.4.1-7. Estimated impacts due to the Project at Lye Brook Wilderness (Class 1 Area)

Pollutant	Averaging Period	SouthCoast Wind Conc. (μg/m³) [a]	Class 1 SIL (μg/m³)
NO_2	Annual	0.013	0.1
PM_{10}	24-hour	0.049	0.3
$PM_{2.5}$	24-hour	0.24	0.27

Source: SouthCoast Wind 2023, Appendix C – OCS Permit Air Quality Modeling Report, Table 5-7.
[a] Scaled proportionally according to the ratio of SouthCoast Wind emissions to Vineyard Wind 1 emissions.
μg/m³ = micrograms of pollutant per cubic meter of air.

Soil, Vegetation, and Growth Analysis

Based on the modeled concentrations in the OCS Application (SouthCoast Wind 2023: Appendix C, Section 5.4.3), it was determined that impacts on soils and vegetation would be lower than applicable thresholds. The Proposed Action would have an overall positive effect on employment and the economy of the region, while few effects on population and housing are expected. SouthCoast Wind will implement certain measures to further reduce the likelihood of any negative effects and promote potential positive effects on regional demographics, employment, and economics (SouthCoast Wind 2023: Appendix C, Section 5.4.4). For further discussion of economic impacts see Section 3.6.3, *Demographics, Employment, and Economics*.

Visibility Analysis

The visibility analysis is an estimate of the impacts due to Project emissions on the visual quality in the area. The USEPA's VISCREEN screening model was used to assess visibility impairment at Class II vistas at Nantucket. As explained in the OCS Application (SouthCoast Wind 2023: Appendix C, Section 5.4.3), the VISCREEN user's guide (USEPA 1992) indicates the maximum short-term emission rates expected during the course of a year should be input to the model. A conservative characterization of O&M emissions was used to represent the most regularly occurring annual activity for the Project. The total emissions from both the daily O&M scenario as well as the major repair scenario were used.

The visibility (plume blight) analysis was conducted for Class II vistas at Nantucket. Plume perceptibility and contrast values modeled for the Class II areas were conservatively compared to Class I criteria because there are no established Class II criteria (SouthCoast Wind 2023: Appendix C, Section 5.4.2). The modeling results in the OCS Application indicate that plume blight and contrast are less than Class I criteria for all viewing angles. Values less than the criteria indicate that the visual impact is not considered adverse and no further visibility analysis is required. Table 3.4.1-8 summarizes the visibility assessment results. Because short-term emission rates during construction would be less than during O&M, visibility impacts during construction would be less than shown in Table 3.4.1-8 and would be less than the Class I impact criteria. USEPA considers that no further analysis is necessary for impacts that are less than the impact criteria.

Table 3.4.1-8. Estimated visibility impacts due to the Project

Light Scattering Angle (degrees)	Perceptibility (ΔE)		Contrast (C_{plume})	
	Modeled Value	Class I Criterion	Modeled Value	Class I Criterion
10	1.808	2	-0.006	±0.05
140	0.656	2	-0.007	±0.05

Source: SouthCoast Wind 2023: Appendix C, Table 5-9.
ΔE = Color difference parameter used to characterize the perceptibility of the difference between two colors. It is used to characterize the perceptibility of a plume on the basis of the color difference between the plume and a viewing background such as the sky, a cloud, or a terrain feature.
C_{plume} = Contrast of a plume against a viewing background such as the sky or a terrain feature.

Onshore Construction

Onshore activities of the Proposed Action would consist primarily of HDD, duct-bank construction, cable-pulling operations, and substation construction. Emissions would be primarily from operation of diesel-powered equipment and vehicle activity, such as bulldozers, excavators, and diesel trucks, and fugitive particulate emissions from excavation and hauling of soil. SouthCoast Wind has proposed measures to reduce emissions including compliance with applicable fuel-efficiency, fuel sulfur content, and emissions standards (COP Volume 2, Table 16-1; SouthCoast Wind 2024).

These emissions would be highly variable and limited in spatial extent at any given period and would result in minor impacts because they would be temporary in nature. Fugitive particulate emissions would vary depending on the spatial extent of the excavated areas, soil type, soil moisture content, and magnitude and direction of ground-level winds.

Air Emissions – Operations and Maintenance

Offshore O&M

During O&M, air quality impacts are anticipated to be smaller in magnitude compared to construction and decommissioning. Offshore O&M activities would consist of WTG operations, planned maintenance, and unplanned emergency maintenance and repairs. The WTGs operating under the Proposed Action would have no pollutant emissions. Emergency generators on the WTGs and the substations would operate only during emergencies or testing, so emissions from these sources would be small and transient. Pollutant emissions from O&M would be mostly the result of operations of ocean vessels and helicopters used for maintenance activities. Crew transfer vessels and helicopters would transport crews to the Wind Farm Area for inspections, routine maintenance, and repairs. Jack-up vessels, multipurpose offshore support vessels, and rock-dumping vessels would travel infrequently to the Wind Farm Area for significant maintenance and repairs. The Proposed Action's contribution would be additive with the impact(s) of any and all other operational activities, including offshore wind activities, that occur in the geographic analysis area. COP Volume 2, Section 3.5 (SouthCoast Wind 2024), provides a more detailed description of offshore and onshore O&M activities, and COP Appendix G, Section 5 (SouthCoast Wind 2024) summarizes emissions during O&M. The annual estimated emissions for O&M are summarized in Table 3.4.1-9.

Table 3.4.1-9. SouthCoast Wind operations and maintenance emissions (criteria pollutants and VOCs in U.S. tons; GHGs in metric tons)

Period	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC	CO_2	CH_4	N_2O	SF_6	CO_2e
Annual	180	729	24	19	28	13	42,569	0.3	2.0	0.1	46,428
Lifetime (33 years)	5,940	24,057	792	627	924	429	1,404,805	9	64	2	1,505,224

Source: COP Appendix G, Table 5-2 (SouthCoast Wind 2024).

BOEM anticipates that air quality impacts from O&M of the Proposed Action would be minor, occurring for short periods of time several times per year during the proposed 33 years.

NAAQS and PSD Dispersion Modeling

As part of the OCS Application (SouthCoast Wind 2023), SouthCoast Wind conducted dispersion modeling to demonstrate that O&M of the Proposed Action will show modeled compliance with the NAAQS and PSD increments. O&M activities were categorized as either O&M Daily Inspection/Routine Maintenance or WTG and OSP Major Repair. The analysis conservatively assumed worst-case short-term and annual operating conditions and accounted for activities that can occur simultaneously in the Lease Area, but at separate/adjacent WTG locations (SouthCoast Wind 2023: Appendix C, Section 4.0). Dispersion modeling was conducted using the models and guidance summarized above for *Offshore Construction*. Table 3.4.1-10 and Table 3.4.1-11 present the summary of model results for comparison to the NAAQS and PSD increments, respectively. The maximum modeled impact includes the contribution from nearby simultaneous-emissions scenarios where applicable. As shown in the tables, results for all pollutants and averaging periods are less than the NAAQS and PSD increments.

Table 3.4.1-10. Estimated pollutant concentrations during O&M compared to NAAQS

Pollutant [a]	Averaging Period	Rank [b]	Modeled Design Conc. [c] (μg/m³)	Background Conc. (μg/m³)	Total Conc. (μg/m³)	NAAQS (μg/m³)	% of NAAQS
NO_2	1-hour	98th %ile	35.90	Included [d]	35.90	188	19%
PM_{10}	24-hour	H2H	10.25	26	36.25	150	24%
$PM_{2.5}$	24-hour	98th %ile	6.55 [e]	16.2	22.75	35	65%
SO_2	1-hour	99th %ile	163.4	7.86	171.21	196	87%
SO_2	3-hour	H2H	141.0	8.65	149.64	1,300	12%

Source: SouthCoast Wind 2023, Appendix C – OCS Permit Air Quality Modeling Report, Table 5-4.

[a] Modeling performed as part of the OCS Application indicates that only 24-hour $PM_{2.5}$ and 1-hour and 24-hour SO_2 are greater than their respective SILs (SouthCoast Wind 2023: Appendix C, Section 5.1.2). Therefore, these are the only pollutants and averaging periods that required additional analysis to demonstrate compliance with the NAAQS. All other pollutants and averaging periods are excluded from the table.

[b] H2H = highest second-highest, 98th %ile = 98th percentile, 99th %ile = 99th percentile

[c] Maximum modeled design concentration over both O&M scenarios. Contributions from nearby simultaneous-emissions scenarios are included.

[d] Seasonal and hourly varying background concentrations were included directly in AERMOD.

[e] Includes $PM_{2.5}$ secondary concentration.

μg/m³ = micrograms of pollutant per cubic meter of air; Conc. = Concentration.

Table 3.4.1-11. Estimated pollutant concentrations during O&M compared to Prevention of Significant Deterioration increments

Pollutant [a]	Averaging Period	Rank [b]	Modeled Design Concentration [c] (μg/m^3)	PSD Increment (μg/m^3)	% of PSD Increment
PM_{10}	24-hour	H2H	10.73	30	36%
$PM_{2.5}$	24-hour	H2H	8.4 [d]	9	93%
SO_2	3-hour	H2H	144.3	512	28%
SO_2	24-hour	H2H	64.0	91	70%

Source: SouthCoast Wind 2023, Appendix C – OCS Permit Air Quality Modeling Report, Table 5-6.
[a] Modeling performed as part of the OCS Application indicates that only 24-hour $PM_{2.5}$ and 1-hour and 24-hour SO_2 are greater than their respective SILs (SouthCoast Wind 2023: Appendix C, Section 5.1.2). Therefore, these are the only pollutants and averaging periods that required additional analysis to demonstrate compliance with PSD increments. All other pollutants and averaging periods are excluded from the table.
[b] H2H = highest second-highest
[c] Maximum modeled design concentration over both O&M scenarios. Contributions from nearby simultaneous scenarios are included.
[d] Includes $PM_{2.5}$ secondary concentration.
μg/m^3 = micrograms of pollutant per cubic meter of air.

Class 1 Wilderness Area Dispersion Modeling

Potential Project construction impacts at Lye Brook Wilderness (Class 1 area) were estimated by scaling impacts at the same location presented by the Vineyard Wind 1 project as a supplemental analysis to their OCS air permit application. The results of the analysis are summarized in Table 3.4.1-7. Because emissions during O&M would be much less than during construction, impacts at the Lye Brook Wilderness during O&M would be less than shown in Table 3.4.1-7 and would be less than the applicable thresholds.

Soil, Vegetation, and Growth Analysis

Based on the modeled concentrations in the OCS Application (SouthCoast Wind 2023: Appendix C, Sections 5.4.3 and 5.4.4), it was determined that impacts on soils and vegetation would be lower than applicable thresholds and that O&M of the Proposed Action would lead to only limited growth and emissions. For further discussion of economic impacts see Section 3.6.3, *Demographics, Employment, and Economics*.

Visibility Analysis

Based on the modeled concentrations in the OCS Application (SouthCoast Wind 2023: Appendix C, Section 5.4.2), it was determined that O&M impacts from plume blight and contrast would be lower than applicable thresholds, as shown in Table 3.4.1-8.

Onshore O&M

Emissions from onshore O&M activities would be limited to periodic use of construction vehicles and equipment. Onshore O&M activities would include occasional inspections and repairs to the onshore substation and splice vaults, which would require minimal use of worker vehicles and construction equipment. SouthCoast Wind intends to primarily use port facilities at New Bedford and/or Fall River, Massachusetts or New London area, Connecticut, or Providence, Rhode Island to support O&M activities. BOEM anticipates that air quality impacts due to onshore O&M from the Proposed Action alone would be minor, intermittent, and occurring for short periods.

Avoided Emissions

Increases in renewable energy could lead to reductions in emissions from fossil-fueled power facilities. SouthCoast Wind used the USEPA Avoided Emissions and Generation Tool (AVERT) (USEPA 2021b) to estimate the emissions avoided as a result of the Proposed Action. Once operational, the Proposed Action would result in annual avoided emissions of 692 tons of NO_X, 313 tons of SO_2, and 4,038,482 tons of CO_2 (COP Appendix G, Table 6-1; SouthCoast Wind 2024). The avoided CO_2 emissions represent about 8 percent of the required GHG emissions reduction from 1990 levels by 2030 in Massachusetts (EEA 2022) or about 72 percent of the required GHG emissions reduction from 1990 levels by 2035 in Rhode Island (OER 2015). The avoided CO_2 emissions are equivalent to the emissions generated by about 800,000 passenger vehicles in a year (USEPA 2020c). Accounting for construction emissions and assuming decommissioning emissions would be the same, and including emissions from future operations, operation of the Proposed Action would offset emissions related to its construction and eventual decommissioning within different time periods of operation depending on the pollutant: SO_2 would be offset in approximately 10 years of operation, and CO_2 in approximately 1 year. (NO_X emissions would not be offset during the project lifetime.) If emissions from future operations and decommissioning were not included, the times required for emissions to “break even” would be shorter. From that point, the Project would be offsetting emissions that would otherwise be generated from another source.

The potential health benefits of avoided emissions can be evaluated using USEPA’s COBRA health impacts screening and mapping tool as discussed in Section 3.4.1.3, *Impacts of Alternative A – No Action on Air Quality*. COBRA was used to analyze the avoided emissions that were calculated for the Proposed Action (COP Appendix G; SouthCoast Wind 2024). Table 3.4.1-12 presents the results.

Table 3.4.1-12. COBRA estimate of annual avoided health effects with Proposed Action

Discount Rate [a] (2023)	Monetized Total Health Benefits (million U.S. dollars/year)		Avoided Mortality (cases/year)	
	Low Estimate [a]	High Estimate [b]	Low Estimate [b]	High Estimate [b]
3%	$15.6	$35.1	1.400	3.167
7%	$13.6	30.9	1.400	3.167

[a] The discount rate is used to express future economic values in present terms. Not all health effects and associated economic values occur in the year of analysis. Therefore, COBRA accounts for the “time value of money” preference (i.e., a general preference for receiving economic benefits now rather than later) by discounting benefits received later (USEPA 2020b).
[b] The low and high estimates are derived using two sets of assumptions about the sensitivity of adult mortality and non-fatal heart attacks to changes in ambient $PM_{2.5}$ levels. Specifically, the high estimates are based on studies that estimated a larger effect of changes in ambient $PM_{2.5}$ levels on the incidence of these health effects (USEPA 2020b).

The overall impacts of GHG emissions can be assessed using “social costs.” The “social cost of carbon,” “social cost of nitrous oxide,” and “social cost of methane”—together, the “social cost of greenhouse gases” (SC-GHG)—are estimates of the monetized damages associated with incremental increases in GHG emissions in a given year.

NEPA does not require monetizing costs and benefits but allows the use of the social cost of carbon, SC-GHG, or other monetized costs and benefits of GHGs in weighing the merits and drawbacks of alternative actions. In January 2023, CEQ issued interim guidance (CEQ 2023) that updates its 2016 guidance document (CEQ 2016) on consideration of GHGs and climate change under NEPA. The interim guidance recommends that agencies provide context for GHG emissions, including through the use of SC-GHG estimates, to translate climate impacts into the more accessible metric of dollars.

For federal agencies, the best currently available estimates of SC-GHG are the interim estimates of the social costs of CO_2, methane, and nitrous oxide developed by the Interagency Working Group (IWG) on SC-GHG and published in its Technical Support Document (IWG 2021). IWG’s SC-GHG estimates are based on complex models describing how GHG emissions affect global temperatures, sea level rise, and other biophysical processes; how these changes affect society through, for example, agricultural, health, or other effects; and monetary estimates of the market and nonmarket values of these effects. One key parameter in the models is the discount rate, which is used to estimate the present value of the stream of future damages associated with emissions in a particular year. The discount rate accounts for the “time value of money,” i.e., a general preference for receiving economic benefits now rather than later, by discounting benefits received later. A higher discount rate assumes that future benefits or costs are more heavily discounted than benefits or costs occurring in the present (i.e., future benefits or costs are less valuable or are a less significant factor in present-day decisions). IWG developed the current set of interim estimates of SC-GHG using three different annual discount rates: 2.5 percent, 3 percent, and 5 percent (IWG 2021).

There are multiple sources of uncertainty inherent in the SC-GHG estimates. Some sources of uncertainty relate to physical effects of GHG emissions, human behavior, future population growth and economic changes, and potential adaptation (IWG 2021). To better understand and communicate the quantifiable uncertainty, the IWG method generates several thousand estimates of the social cost for a specific gas, emitted in a specific year, with a specific discount rate. These estimates create a frequency distribution based on different values for key uncertain climate model parameters. The shape and characteristics of that frequency distribution demonstrate the magnitude of uncertainty relative to the average or expected outcome.

To further address uncertainty, IWG recommends reporting four SC-GHG estimates in any analysis. Three of the SC-GHG estimates reflect the average damages from the multiple simulations at each of the three discount rates. The fourth value represents higher-than-expected economic impacts from climate change. Specifically, it represents the 95th percentile of damages estimated, applying a 3-percent annual discount rate for future economic effects. This is a low-probability but high-damage scenario and represents an upper bound of damages within the 3-percent discount rate model. The estimates below follow the IWG recommendations.

Table 3.4.1-13 presents the SC-GHG associated with estimated emissions from the Proposed Action. These estimates represent the present value of future market and nonmarket costs associated with CO_2, methane, and nitrous oxide emissions. In accordance with IWG's recommendation, four estimates were calculated based on IWG estimates of social cost per metric ton of emissions for a given emissions year and SouthCoast Wind's estimates of emissions in each year. In Table 3.4.1-13, negative values represent social benefits of avoided GHG emissions. The negative values for net SC-GHG indicate that the impact of the Proposed Action on GHG emissions and climate would be a net benefit in terms of SC-GHG.

Table 3.4.1-13. Estimated social cost of GHGs associated with the Proposed Action

Description	Social Cost of GHGs (2020$) [a]			
	Average Value, 5% discount rate	Average Value, 3% discount rate	Average Value, 2.5% discount rate	95th Percentile Value, 3% discount rate
SC-CO_2				
Construction, operation, and decommissioning	$60,000,000	$248,000,000	$384,000,000	$754,000,000
Avoided emissions [b]	-$1,108,000,000	-$4,781,000,000	-$7,446,000,000	-$14,654,000,000
Net SCC-CO_2	-$1,048,000,000	-$4,533,000,000	-$7,062,000,000	-$13,900,000,000
SC-CH_4				
Construction, operation, and decommissioning	$0	$0	$0	$0
Avoided emissions	-$4,000,000	-$11,000,000	-$16,000,000	-$31,000,000
Net SCC-CH_4	-$4,000,000	-$11,000,000	-$16,000,000	-$31,000,000
SC-N_2O				
Construction, operation, and decommissioning	$1,000,000	$4,000,000	$6,000,000	$10,000,000
Avoided emissions	-$4,000,000	-$18,000,000	-$28,000,000	-$48,000,000
Net SCC-N_2O	-$3,000,000	-$14,000,000	-$22,000,000	-$38,000,000
SC-SF_6				
Construction, operation, and decommissioning	$1,000,000	$3,000,000	$4,000,000	$8,000,000
Avoided emissions	$0	$0	$0	$0
Net SCC-SF_6	$1,000,000	$3,000,000	$4,000,000	$8,000,000

Description	Social Cost of GHGs (2020$) [a]			
	Average Value, 5% discount rate	Average Value, 3% discount rate	Average Value, 2.5% discount rate	95th Percentile Value, 3% discount rate
SC-GHG[3]				
Construction, operation, and decommissioning	$62,000,000	$255,000,000	$394,000,000	$772,000,000
Avoided emissions	-$1,116,000,000	-$4,810,000,000	-$7,490,000,000	-$14,733,000,000
Net SC-GHG	-$1,054,000,000	-$4,555,000,000	-$7,096,000,000	-$13,961,000,000

Estimates are the sum of the social costs for CO_2, methane, nitrous oxide, and SF_6 over the Project lifetime.
Estimates are rounded to the nearest $1,000,000.
[a] The following calendar years were assumed in calculating SC-GHG: construction 2025–2031, operation (33 years) 2032–2064, and decommissioning 2065–2066.
[b] Negative cost values indicate benefits.

Table 3.4.1-14 presents the annual emissions, avoided emissions, and net emissions of CO_2e over the operational lifetime of the Proposed Action. Net emissions are the Proposed Action emissions minus the avoided emissions. The No Action Alternative would result in no emissions during construction and O&M because no project would be built, but would also offer no avoided emissions, resulting in higher GHG emissions over the project duration due to not displacing fossil-fueled power generation via offshore wind. The emissions not avoided, 3,663,630 metric tons per year of CO_2e (Table 3.4.1-14), would be equivalent to about 800,000 additional passenger vehicles per year. These estimates are relative to the 2018 grid configuration, but the actual annual quantity of avoided emissions attributable to this proposed facility is expected to diminish over time if the electric grid becomes lower-emitting due to the addition of other renewable energy facilities and retirement of high-emitting generators.

Air Emissions–Decommissioning

SouthCoast Wind would decommission the Proposed Action at the end of the Proposed Action's operational lifetime. SouthCoast Wind anticipates that all structures above the seabed level or aboveground would be completely removed. The decommissioning sequence would generally be the reverse of the construction sequence, involve similar types and numbers of vessels, and use similar equipment.

The dismantling and removal of the turbine components (blades, nacelle, and tower) and other offshore components would largely be a "reverse installation" process subject to the same constraints as the original construction phase. Onshore decommissioning activities would include removing facilities and equipment and restoring the sites to pre-Project conditions where warranted. Emissions from decommissioning were not quantified but are expected to be less than for construction. SouthCoast Wind anticipates pursuing a separate OCS air permit for those activities because it is assumed that marine vessels, equipment, and construction technology will change substantially in the next 33 years and in the future will have lower emissions than current vessels and equipment. SouthCoast Wind anticipates minor and temporary air quality impacts from the Proposed Action due to decommissioning.

Accidental Releases

The Proposed Action could release VOCs or HAPs because of accidental chemical spills. The Proposed Action would have up to about 75,000 gallons (284,000 liters) of coolants, 1,188,650 gallons (4.5 million liters) of oils and lubricants, and 332,300 gallons (1.3 million liters) of diesel fuel in its wind turbine and substation structures. Accidental releases including spills from vessel collisions and allisions may lead to short-term periods of VOC and HAP emissions through evaporation. VOC emissions also would be a precursor to ozone formation. Air quality impacts would be short term and limited to the local area at and around the accidental release location. BOEM anticipates that a major spill is very unlikely due to vessel and offshore wind energy industry safety measures, as well as the distributed nature of the material. BOEM anticipates that these activities would have a negligible air quality impact as a result of the Proposed Action alone.

Table 3.4.1-14. Net Emissions of CO_2e for Each Alternative

Alternative	CO_2e Emissions (metric tons) [a,b]												
	Construction 2025–2031								Operation 2032–2064		Construction + Operation 2025–2064		
	2025	2026	2027	2028	2029	2030	2031	Total Construction	O&M Emissions (Annual)	Avoided Emissions (Annual)	Net Emissions [c] (Annual)	Operational Lifetime Net Emissions	Total Lifetime Net Emissions
A (No Action)	0	0	0	0	0	0	0	0	0	0	3,617,202 [d]	0	128,227,054 [d]
B (Proposed Action) and alternatives C through H [e]	376,201	376,201	376,201	376,201	376,201	376,201	376,201	2,388,972	46,428	-3,663,630	-3,617,202	-126,602,085	-124,213,113

[a] Positive values are emissions increases; negative values are emissions decreases.

[b] Emissions from decommissioning are not included.

[c] Annual net emissions equal O&M minus avoided emissions.

[d] Represents emissions from the grid in the absence of the Project, relative to the Proposed Action.

[e] Emissions for Alternatives B through H are estimated as the same as for the Proposed Action based on the maximum number of WTGs for each alternative.

Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned non-offshore wind and offshore wind activities.

Air emissions – offshore construction: Air quality impacts due to offshore wind projects occurring in the geographic analysis area are anticipated to be small relative to larger emissions sources, such as fossil-fueled power facilities. The largest air quality impacts are anticipated during construction, with smaller and more infrequent impacts anticipated during decommissioning. During the construction phase, the total emissions of criteria pollutants and ozone precursors from all offshore wind projects, including the Proposed Action, proposed to occur in the geographic analysis area, summed over all construction years, are estimated to be 42,780 tons of CO, 205,771 tons of NO_X, 11,705 tons of PM_{10}, 7,155 tons of $PM_{2.5}$, 5,997 tons of SO_2, 7,321 tons of VOCs, and 13,835,524 tons of CO_2 (Appendix D, Table D2-4). Most emissions would occur from diesel-fueled construction equipment, vessels, and commercial vehicles. The magnitude of the emissions and the resulting air quality impacts would vary spatially and temporally during the construction phases.

The Proposed Action would incrementally contribute to the cumulative air quality impacts from ongoing and planned activities associated with offshore construction, which would be moderate during construction. The Proposed Action would add an average of approximately 22 percent of the total offshore wind project emissions that may generate impacts, depending on pollutant, due to construction activities occurring in the geographic analysis area. This suggests that most of the air quality impacts resulting from offshore wind development would not be due to the Proposed Action, and the addition of the Proposed Action would represent between one-fifth and one-quarter of the total air quality impacts. Construction activity would occur at different locations and could overlap temporally with activities at other locations, including operational activities at previously constructed project locations. As a result, air quality impacts would shift spatially and temporally across the geographic analysis area. The largest combined air quality impacts from offshore wind activities would occur during overlapping construction and decommissioning of multiple offshore wind projects. Construction of the Proposed Action is anticipated to overlap with up to 10 other offshore wind projects, depending on the year, between 2025 and 2031 (Appendix D, Table D2-4). Most air quality impacts would occur offshore because the highest emissions would occur in the offshore region. Air quality impacts onshore would be less because of the distance from the Wind Farm Area to the nearest onshore areas (Martha's Vineyard and Nantucket). Although air quality offshore is subject to the NAAQS in federal waters and the OCS permit area, the amount of human exposure offshore is typically very low. Ozone and some particulate matter are formed in the atmosphere from precursor emissions and can be transported longer distances, potentially over land. Cumulative impacts would be greatest during overlapping construction activities, but these effects would be short term in nature because the overlap in the geographic analysis area would be limited in time.

Air emissions – onshore construction: The contribution of the Proposed Action to cumulative air quality impacts from ongoing and planned activities associated with onshore construction would be minor. Emissions from ongoing and planned activities, including the Proposed Action, would be highly variable and limited in spatial extent at any given period. Fugitive particulate emissions would vary depending on the spatial extent of the excavated areas, soil type, soil moisture content, and magnitude and direction of ground-level winds.

Air emissions – O&M: The contribution of O&M emissions of the Proposed Action to cumulative air quality impacts from ongoing and planned activities would be minor. O&M from ongoing and planned activities could begin in 2024. Emissions would largely be due to the same source types as for the Proposed Action, including commercial vessel traffic, air traffic (such as helicopters), and operation of emergency diesel generators. Such activity would result in short-term, intermittent, and widely dispersed emissions. Ongoing and planned activities, including the Proposed Action, are estimated to emit 1,477 tons per year of CO, 5,802 tons per year of NO_X, 176 tons per year of PM_{10}, 156 tons per year of $PM_{2.5}$, 103 tons per year of SO_2, 113 tons per year of VOCs, and 459,188 tons per year of CO_2 when all projects are operating (Appendix D, Table D2-4). Anticipated impacts on air quality from O&M emissions would be transient, small in magnitude, and localized. Additionally, some emissions associated with O&M activities could overlap with other projects' construction-related emissions. Comparison of the combined emissions from all offshore wind projects to the emissions contributions from the Proposed Action alone shown in Table 3.4.1-9 shows that the increases in air quality impacts from the Proposed Action would be small for most pollutants relative to those of the combined total of the other planned offshore wind projects. In summary, the largest magnitude air quality impacts and largest spatial extent would result from the overlapping operations activities from the multiple offshore wind projects occurring in the geographic analysis area. A net improvement in air quality is expected on a regional scale as wind projects begin operation and displace emissions from fossil-fueled sources.

Air emissions – decommissioning: The contribution of decommissioning of the Proposed Action to the cumulative air quality impacts from ongoing and planned activities would be minor. The decommissioning process for all offshore wind projects is expected to be similar to that for SouthCoast Wind, and impacts would be similar to those of SouthCoast Wind decommissioning. Because the emissions related to onshore activities would be widely dispersed and transient, BOEM expects all air quality impacts to occur close to the emitting sources. If decommissioning activities for projects overlap in time, then impacts could be greater for the duration of the overlap.

Accidental releases: Based on Appendix D, Table D3-3, there would be up to about 1,908,481 gallons (7.2 million liters) of coolants, 8,024,098 gallons (30.3 million liters) of oils and lubricants, and 2,061,364 gallons (7.8 million liters) of diesel fuel contained in the 1,069 structures among the Proposed Action and ongoing and planned activities in the geographic analysis area. In context of reasonably foreseeable environmental trends, the Proposed Action would contribute to the combined accidental release impacts on air quality from ongoing and planned activities including offshore wind activities, which would be negligible due to the short-term nature and localized potential effects. Accidental spills would occur infrequently over the 33-year period with a higher probability of spills during construction of projects. However, these spills would not be expected to contribute appreciably to overall impacts on air quality, as the total storage capacity in the geographic analysis area is considerably less than the existing volumes of hazardous liquids being transported by ongoing activities and is distributed among many different locations and containers.

Conclusions

Impacts of the Proposed Action: The Proposed Action would result in a net decrease in overall emissions over the region compared to the installation of a traditional fossil-fueled power facility. Although there would be some short-term air quality impacts due to various activities associated with construction, maintenance, and eventual decommissioning, these emissions would be relatively small and limited in duration. The Proposed Action would result in air quality-related health effects avoided in the region due to the reduction in emissions associated with fossil-fueled energy generation (Table 3.4.1-12). As stated, the impact from air pollutant emissions is anticipated to be minor, and the impact from accidental releases is expected to be negligible. Considering all of the IPFs together, **minor to moderate adverse** air quality impacts would be anticipated for a limited time during construction, maintenance, and decommissioning, but there would be a **minor to moderate beneficial** impact on air quality near the Wind Farm Area and the surrounding region overall to the extent that energy produced by the Proposed Action would displace energy produced by fossil-fueled power facilities. SouthCoast Wind has proposed measures to reduce emissions including compliance with applicable fuel-efficiency, fuel sulfur content, and emissions standards (COP Volume 2, Table 16-1; SouthCoast Wind 2024). Because of the amounts of emissions, the fact that emissions would be spread out in time (7 years for construction[6] and then lesser emissions annually during operation), and the large geographic area over which they would be dispersed (throughout the 127,388-acre [51,552-hectare] Lease Area and the vessel routes from the onshore facilities), air pollutant concentrations associated with the Proposed Action are not expected to exceed the NAAQS and Massachusetts AAQS.

Cumulative Impacts of the Proposed Action: BOEM anticipates that the cumulative impacts on air quality in the geographic analysis area would be **minor to moderate adverse** and **minor to moderate beneficial**. In context of reasonably foreseeable environmental trends, the incremental impacts contributed by the Proposed Action to the cumulative impacts on air quality would be noticeable. The main driver for this impact rating is emissions related to construction activities increasing commercial vessel traffic, air traffic, and truck and worker vehicle traffic. Combustion emissions from construction equipment and fugitive emissions would be higher during overlapping construction activities but short term in nature, because the overlap would be limited in time. Therefore, the adverse impact on air quality would likely be moderate because, while emissions would incrementally increase ambient pollutant concentrations, they are not expected to exceed the NAAQS and Massachusetts AAQS. The Proposed Action and other offshore wind projects would benefit air quality in the region surrounding the projects to the extent that energy produced by the projects would displace energy produced by fossil-fueled power facilities. Though the benefit is regional, BOEM anticipates a moderate beneficial impact because the magnitude of the potential reduction in emissions from displacing fossil-fueled-generated power would be small relative to total energy generation emissions in the area.

[6] As noted in Table 3.4.1-4, South Coast Wind has revised its construction schedule to 7 years from 4 years; however, the SouthCoast Wind COP Appendix G (the source for the emissions data in the EIS analysis) reflects 4 years of construction emissions. BOEM expects that impacts in each year of a 7-year construction schedule would be less than with a 4-year construction schedule because construction would be spread out over 7 years instead of 4 years.

3.4.1.6 Impacts of Alternative C on Air Quality

Impacts of Alternative C: Both Alternative C-1 and Alternative C-2 would reduce the offshore export cable route distance and increase the onshore export cable route distance, though the total cable route distances would be similar to those of the Proposed Action. Alternative C-1 would reduce the offshore export cable route by 9 miles (14 kilometers) and increase the onshore export cable route by 9 miles (14 kilometers), while Alternative C-2 would reduce the total offshore export cable route by 12 miles (19 kilometers) and increase the total onshore export cable route by 13 miles (21 kilometers). Mile for mile, onshore construction has greater potential for localized air quality impacts than offshore construction because exposure of the public to emissions close to construction activities is much more likely onshore than offshore. As a result, with respect to cable construction, Alternative C-1 could have greater potential for air quality impacts onshore than the Proposed Action, and Alternative C-2 could have greater potential for air quality impacts onshore than Alternative C-1.

Alternative C would have the same number of WTGs and OSSs and the same onshore facilities as the Proposed Action, so the potential for accidental releases with Alternative C would be the same as for the Proposed Action.

Cumulative Impacts of Alternative C: In context of reasonably foreseeable environmental trends, the cumulative impacts of Alternative C would be similar to those of the Proposed Action.

Conclusions

Impacts of Alternative C: The overall impacts of Alternative C on air quality, climate, and accidental releases would be similar to those of the Proposed Action. The same construction, O&M, and decommissioning activities as under the Proposed Action would still occur. Therefore, expected impacts associated with Alternative C alone would be **minor to moderate adverse**. Alternative C-1 could have greater potential for air quality impacts onshore than the Proposed Action, and Alternative C-2 could have greater potential for air quality impacts onshore than Alternative C-1. However, the change in emissions associated with Alternative C-1 or Alternative C-2 would not change the impact magnitude. As under the Proposed Action, Alternative C would result in **minor to moderate beneficial** impacts on air quality and climate overall due to reduced emissions from fossil-fueled power plants.

Cumulative Impacts of Alternative C: In context of reasonably foreseeable environmental trends, the cumulative impacts on air quality associated with Alternative C-1 and Alternative C-2 would be similar to the Proposed Action and result in **minor to moderate adverse** and **minor to moderate beneficial** impacts.

3.4.1.7 Impacts of Alternative D (Preferred Alternative) on Air Quality

Impacts of Alternative D: Alternative D would install six fewer WTGs than the Proposed Action and, therefore, could have slightly lower emissions from offshore construction and operation compared to the Proposed Action. Avoided emissions and the associated benefits, including net reductions in regional GHG emissions, also could be less than for the Proposed Action due to the reduction in the number of

WTGs. Additionally, Alternative D could have a slightly lower potential for accidental releases from offshore construction and operation compared to the Proposed Action as a result of the reduced number of WTGs.

Cumulative Impacts of Alternative D: In context of reasonably foreseeable environmental trends, cumulative impacts of Alternative D would be similar to those of the Proposed Action.

Conclusions

Impacts of Alternative D: The overall impacts of Alternative D on air quality, climate, and accidental releases would be similar to those of the Proposed Action. While Alternative D could have slightly fewer impacts from offshore construction and operation compared to the Proposed Action due to the reduction in the number of WTGs, the change in emissions would not change the impact magnitude. Therefore, expected impacts associated with Alternative D alone would be **minor to moderate adverse.** As under the Proposed Action, Alternative D would result in **minor to moderate beneficial** impacts on air quality and climate overall due to reduced emissions from fossil-fueled power plants.

Cumulative Impacts of Alternative D: In context of reasonably foreseeable environmental trends, the cumulative impacts on air quality associated with Alternative D would be similar to the Proposed Action and result in **minor to moderate adverse** and **minor to moderate beneficial** impacts.

3.4.1.8 Impacts of Alternatives E and F on Air Quality

Impacts of Alternatives E and F: The air quality impacts associated with Alternative E would be generally similar to those of the Proposed Action. This alternative would have the same number of WTGs and same onshore facilities as the Proposed Action but would use different types of WTG and OSP foundation structures. Alternative E-1 would use piled foundations (monopile or piled jacket), Alternative E-2 would use suction bucket jackets, and Alternative E-3 would use GBS foundations. Construction emissions could differ among these foundation types because of differences in the types of equipment used, the numbers of vessel trips, and the duration of certain construction tasks. However, BOEM expects that emissions from foundation construction would not differ substantially among Alternative E-1, Alternative E-2, and Alternative E-3 and would be similar to the Proposed Action.

Alternative F would have the same number of WTGs as the Proposed Action, and all other Project components would be the same as with the Proposed Action. Reducing the number of Falmouth offshore export cables to up to three may slightly reduce emissions associated with cable-laying activities, but the emissions would not differ substantively from the Proposed Action and would not change the impact magnitude. Thus, the air quality and climate impacts associated with Alternative F would be approximately the same as those of the Proposed Action.

Cumulative Impacts of Alternatives E and F: In context of reasonably foreseeable environmental trends, the cumulative impacts of Alternatives E and F on air quality would be similar to those of the Proposed Action.

Conclusions

Impacts of Alternatives E and F: The overall impacts of Alternative E on air quality, climate, and accidental releases would be generally similar to those of the Proposed Action because the only differences would be in the construction activity associated with offshore foundation installation. Expected impacts associated with Alternative E alone would be **minor to moderate adverse**. The total offshore construction emissions are not expected to differ substantially among Alternative E-1, Alternative E-2, and Alternative E-3 from the offshore construction emissions for the Proposed Action. As under the Proposed Action, Alternative E would result in **minor to moderate beneficial** impacts on air quality and climate overall due to reduced emissions from fossil-fueled power plants.

The overall impacts of Alternative F on air quality, climate, and accidental releases would be approximately the same as those of the Proposed Action because the reduction in the number of individual offshore cables along the same cable route are not anticipated to have a substantive reduction in emissions. As a result, Alternative F would have the same **minor to moderate adverse** impacts on air quality as the Proposed Action. As under the Proposed Action, Alternative F would result in **minor to moderate beneficial** impacts on air quality and climate overall due to reduced emissions from fossil-fueled power plants.

Cumulative Impacts of Alternatives E and F: In context of reasonably foreseeable environmental trends, the cumulative impacts on air quality associated with Alternative E and F would be similar to the Proposed Action and result in **minor to moderate adverse** and **minor to moderate beneficial** impacts.

3.4.1.9 Comparison of Alternatives

This section provides a summary comparison of the anticipated impacts of ongoing activities, planned activities, and Project impacts.

Under the No Action Alternative, air quality would continue to follow current regional trends and respond to IPFs introduced by other ongoing and planned activities. Ongoing and planned non-offshore wind activities and offshore wind activities would have continuing regional impacts primarily through air pollutant emissions and accidental releases. Combined impacts of ongoing and planned non-offshore wind activities as well as offshore wind activities, including air pollutant emissions and GHGs, would be minor to moderate adverse because the emissions would incrementally increase ambient pollutant concentrations, though not by enough to cause a violation of the NAAQS or Massachusetts AAQS. Offshore wind projects likely would lead to reduced emissions from fossil-fueled power-generating facilities and consequently minor to moderate beneficial impacts on air quality and climate.

Under the Proposed Action, air quality impacts would occur due to emissions associated with construction, O&M, and eventual decommissioning, but these impacts are not expected to lead to violation of the NAAQS or Massachusetts AAQS. Impacts would be minor to moderate adverse because the emissions would incrementally increase ambient pollutant concentrations, though not by enough to cause a violation of the NAAQS or Massachusetts AAQS. There would be a minor to moderate beneficial impact on air quality in the region overall to the extent that energy produced by the Projects would displace energy produced by fossil-fueled power plants. The Proposed Action would result in air quality–related health effects avoided in the region due to the reduction in emissions associated with fossil-fueled energy generation.

Alternative C would have impacts similar to those of the Proposed Action. Therefore, expected impacts associated with Alternative C alone would be minor to moderate adverse. Alternative C-1 could have greater potential for air quality impacts onshore than the Proposed Action, and Alternative C-2 could have greater potential for air quality impacts onshore than Alternative C-1. As under the Proposed Action, Alternative C would result in minor to moderate beneficial impacts on air quality and climate overall due to reduced emissions from fossil-fueled power plants.

Alternative D would install up to six fewer WTGs than the Proposed Action and, therefore, could have slightly lower emissions from offshore construction and operation compared to the Proposed Action. Avoided emissions and the associated benefits, including net reductions in regional GHG emissions, also could be less than for the Proposed Action due to the reduction in the number of WTGs. Also, Alternative D could have a slightly lower potential for accidental releases from offshore construction and operation compared to the Proposed Action as a result of the reduced number of WTGs.

Alternative E would have generally similar air quality impacts to those of the Proposed Action. This alternative would have the same number of WTGs and same onshore facilities as the Proposed Action but would use different types of WTG and OSP foundation structures. BOEM expects that emissions from foundation construction would not differ substantially among Alternative E-1, Alternative E-2, and Alternative E-3 and would be similar to those of the Proposed Action.

Alternative F would have the same number of WTGs as the Proposed Action, and all other Project components would be the same as with the Proposed Action. Reducing the number of Falmouth offshore export cables to up to three could slightly reduce emissions associated with cable-laying activities, but the emissions would not differ substantively from the Proposed Action and would not change the impact magnitude. Thus, the air quality and climate impacts associated with Alternative F would be approximately the same as those of the Proposed Action.

In context of other reasonably foreseeable environmental trends, and considering all the IPFs together, BOEM anticipates that the overall impacts associated with the Proposed Action when combined with the impacts from ongoing and planned activities including offshore wind would be minor to moderate adverse and minor to moderate beneficial. The overall adverse impact on air quality would likely be moderate because pollutant concentrations are not expected to exceed the NAAQS or Massachusetts AAQS. The Proposed Action and other offshore wind projects would benefit air quality in the region surrounding the Project to the extent that energy produced by the Project would displace energy produced by fossil-fueled power plants. BOEM anticipates an overall minor to moderate beneficial impact because the magnitude of this potential reduction would be small relative to total energy generation emissions in the area. Overall impacts with Alternatives B, C, E, and F would be similar to those with the Proposed Action. Alternative D could have slightly fewer impacts from offshore construction and operation compared to the Proposed Action due to the reduction in the number of WTGs.

3.4.1.10 Proposed Mitigation Measures

Additional mitigation measures identified by BOEM and cooperating agencies as a condition of state and federal permitting, or through agency-to-agency negotiations, are described in detail in Appendix G, Tables G-2 through G-4 and summarized and assessed in Table 3.4.1-15. If one or more of the measures analyzed here are adopted by BOEM or cooperating agencies, some adverse impacts on bats could be further reduced.

Table 3.4.1-15. BOEM or agency-proposed measures (also identified in Appendix G, Table G-3): air quality

Measure	Description	Effect
Engines that meet or exceed emission control requirements	Use engines manufactured and installed to meet or exceed emissions control requirements. Engine manufacturers will incorporate pollution control measures into their designs. Techniques used could include ensuring complete combustion in the engines by controlling combustion air, controlling fuel flow, ensuring complete mixing, and staging combustion; avoiding hot spots in the combustion process that can form NO_X by staging combustion, injecting water, recirculating flue gas, and otherwise cooling the system; and using post-combustion controls to remove air pollutants after they have formed by adding particulate filters, oxidation catalysts, and selective catalytic reduction systems.	Measure will reduce emissions by ensuring that all engines meet or exceed emission control requirements.
Vessel engines that meet or exceed applicable marine engine standards	Vessel engines will use a combination of combustion and post-combustion controls to meet or exceed applicable marine engine standards, including the International Convention for the Prevention of Pollution from Ships (MARPOL) Annex VI (for foreign vessels); 40 CFR 89 (for Tier 1 and 2 domestic marine diesel engines smaller than 37 kW); Control of Emissions from Marine Compression-Ignition Engines; 40 CFR 94 (for Tier 1 and 2 domestic marine diesel engines larger than 37 kW); and Control of Emissions from New and In-Use Marine Compression-Ignition Engines and Vessels, 40 CFR 1042 (for Tier 3 and 4 domestic marine diesel engines). Onroad engines, nonroad engines, and aircraft engines will meet or exceed similar standards.	Measure will reduce emissions by ensuring that all vessel engines meet or exceed applicable marine engine standards.
Best available engines/fuels	Use the best available engines/fuels. Construction vessels will be supplied by contractors for temporary use on the Project. For O&M, SouthCoast Wind can specify the vessel used through long-term contracting or outright purchase. Nonroad engine emissions will be minimized using engines compliant with 40 CFR 1039, Control of Emissions from	Measure will reduce emissions by ensuring use of best available engines/fuels.

Measure	Description	Effect
	New and In-Use Nonroad Compression-Ignition Engines, i.e., “Tier 4” engines, where practicable.	
Marine diesel fuel will comply with the fuel sulfur limit of 15 ppm	Marine diesel fuel will comply with the fuel sulfur limit of 15 ppm per 40 CFR 80, which is the same limit as onshore ULSD. For heavier residual fuel oils used in Category 2 and Category 3 engines, and for engines on foreign vessels, the Project will comply with the fuel oil sulfur content limit of 1,000 ppm set in MARPOL VI and corresponding USEPA regulations. Nonroad engines will use ultra-low sulfur diesel. The use of clean fuels will minimize emissions from fuel impurities and allow for cleaner combustion.	Measure will reduce emissions of sulfur oxides from marine vessels by requiring compliance with fuel sulfur limit.
BMPs, innovative tools and/or technologies to minimize emissions from vessel operations	Implement BMPs and investigate the use of innovative tools and/or technologies to minimize air emissions from vessel operations. Specifically, SouthCoast Wind will optimize construction and O&M activities to minimize vessel operating times and loads. This will include weather monitoring, forecasting, and Project tracking to minimize emissions resulting from non-productive time, and incentives for contractor fuel savings.	Measure will reduce emissions by ensuring that BMPs are implemented and innovative tools and/or technologies are investigated.
Meet or exceed permit requirements and comply with all applicable air quality regulatory requirements	Air permit requirements will be met or exceeded, and SouthCoast Wind will comply with all applicable air quality regulatory requirements. A key element will be obtaining the OCS air permit. SouthCoast Wind will comply with other air- related regulatory requirements by using engines manufactured and maintained in compliance with the appropriate standards, which include New Source Performance Standards, National Emissions Standards for Hazardous Air Pollutants, and federal standards for nonroad and marine diesel engines. If onshore stationary equipment triggers any requirement to obtain a Massachusetts or Rhode Island air permit, as applicable (including obtaining coverage under a general permit), SouthCoast Wind will obtain the required permit.	Measure will reduce emissions by ensuring that permit requirements are met or exceeded and SouthCoast Wind complies with all applicable air quality regulatory requirements.
Document in OCS air permit compliance with air quality requirements	Any required OCS air permit will address documentation of compliance with ambient air standards, documentation of no adverse impact on air quality related values at Class I Areas, control technology review, and emissions offsets.	Measure will reduce emissions by ensuring that all air quality requirements specified in the OCS air permit are met.
Use SF_6-free switchgear	This mitigation measure requires that the applicant use SF_6-free switchgear. BOEM is proposing additional mitigation requirements to minimize SF_6 emissions in the event that the applicant is not able to use SF_6-free switch gear. The additional mitigation is as follows: • Follow manufacturer recommendations for limiting leaks and for service and repair of the affected breakers and switches. • Perform repairs promptly when significant leaks are detected.	Measure will reduce GHG emissions by ensuring that SF_6 is not used or that emissions would be minimized in the event that SouthCoast Wind is not able to use SF_6-free switch gear.

Measure	Description	Effect
	• Conduct visual inspections of the switchgear and monitoring equipment according to manufacturer recommendations. • Create alarms based on the pressure readings in the breakers and switches, so leaks can be detected when substantial SF_6 leakage occurs. Upon a detectable pressure drop that is greater than 10% of the original pressure (accounting for ambient air conditions), perform maintenance to fix seals as soon as feasible. If an event requires removal of SF_6, the affected major component(s) will be replaced with new component(s). • Capture and recycle any SF_6 removed from breakers and switches during maintenance. Keep a log of all detected leaks and maintenance procedures potentially affecting SF_6 emissions from circuit breakers/switches.	

Measures Incorporated in the Preferred Alternative

BOEM has identified the measures in Table 3.4.1-15, to be incorporated in the Preferred Alternative. These measures, if adopted, would reduce or eliminate GHG emissions from SF_6 leakage and would result in the coordinated development and implementation of preventive and compensatory mitigation measures intended to offset air quality impacts. Adoption of these measures would increase the beneficial GHG impacts of the Preferred Alternative or other action alternatives because GHG emissions from SF_6 leakage would be reduced or eliminated.

3.4 Physical Resources

3.4.2 Water Quality

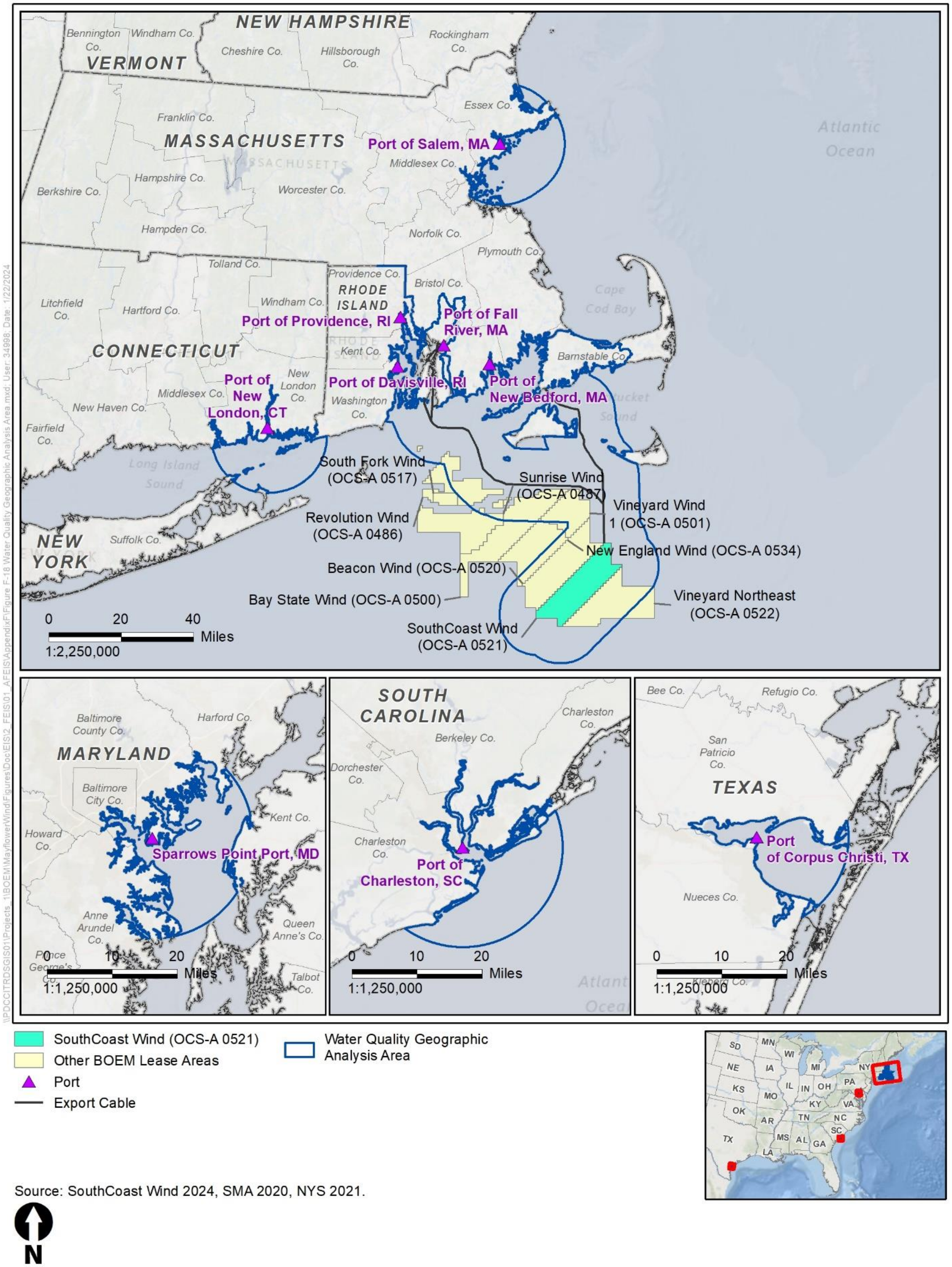
This section discusses potential impacts on water quality from the proposed Project, alternatives, and ongoing and planned activities in the water quality geographic analysis area. The water quality geographic analysis area, as shown on Figure 3.4.2-1, includes coastal waters within a 10-mile (16-kilometer) buffer around the Offshore Project area and a 15.5-mile (25-kilometer) buffer around the ports that may be used by the Project. In addition, the geographic analysis area includes an onshore component that includes any sub-watershed that is intersected by the Onshore Project area. The offshore geographic analysis area accounts for some transport of water masses due to ocean currents. The onshore geographic analysis area was chosen to capture the extent of the natural network of waterbodies that could be affected by construction and operation activities of the proposed Project.

3.4.2.1 Description of the Affected Environment

Surface waters in the geographic analysis area include: (1) coastal onshore waterbodies that generally include freshwater ponds, streams, and rivers; and (2) coastal marine waters that generally include saline and tidal/estuarine waters, such as Nantucket Sound, Rhode Island Sound, Mount Hope Bay, Sakonnet River and the Atlantic Ocean. Surface waters within most of the geographic analysis area and all of the Onshore Project areas are coastal marine waters.

The following key parameters characterize water quality. Some of these parameters are accepted proxies for ecosystem health (e.g., dissolved oxygen [DO], nutrient levels), while others delineate coastal onshore waters from coastal marine waters (e.g., temperature, salinity):

- **Nutrients:** Key ocean nutrients include nitrogen and phosphorous. Photosynthetic marine organisms need nutrients to thrive (with nitrogen being the primary limiting nutrient), but excess nutrients can cause problematic algal blooms. Algal blooms can significantly lower DO concentration, and toxic algal blooms can contaminate human food sources. Both natural and human-derived sources of pollutants contribute to nutrient excess.
- **Dissolved oxygen:** The amount of DO in water determines the amount of oxygen that is available for aquatic life to use. Temperature strongly influences DO content, which is further influenced by local biological processes. For a marine system to maintain a healthy environment, DO concentrations should be above 5 mg/L; lower levels may affect sensitive organisms (USEPA 2000).
- **Chlorophyll a:** Chlorophyll *a* is a measure of how much photosynthetic life is present. Chlorophyll *a* levels are sensitive to changes in other water parameters, making it a good indicator of ecosystem health. USEPA considers estuarine and marine levels of chlorophyll *a* under 5 micrograms per liter (µg/L) to be good, 5 to 20 µg/L to be fair, and over 20 µg/L to be poor (USEPA 2015).
- **Salinity***:* Salinity, or salt concentration, also affects species distribution. In general, seasonal variation in the region is smaller than year-to-year variation and less predictable than temperature changes (Kaplan 2011).



Source: SouthCoast Wind 2024, SMA 2020, NYS 2021.

Figure 3.4.2-1. Water Quality geographic analysis area

- **Water temperature**: Water temperature heavily affects species distribution in the ocean. Large-scale changes to water temperature may affect seasonal phytoplankton blooms.
- **Turbidity:** Turbidity is a measure of water clarity, which is typically expressed as a concentration of total suspended solids (TSS) in the water column but can also be expressed as nephelometric turbidity units (NTU). Turbid water lets less light reach the seafloor, which may be detrimental to photosynthetic marine life (CCS 2017). In estuaries, a turbidity level of 0 to 10 NTUs is healthy while a turbidity level over 15 NTUs is detrimental (NOAA 2018). Marine waters generally have less turbidity than estuaries.

States also assess a variety of other water quality parameters as part of state requirements to evaluate and list state waters as impaired under CWA Section 303(d) requirements. Other water quality parameters assessed typically include, but are not limited to, concentrations of metals, pathogens, bacteria, pesticides, biotoxins, PCBs, and other chemicals. If a surface water is considered non-attaining under the assessment, this means a designated beneficial use (e.g., recreation, fish consumption) is impaired by an exceedance of one or more water quality parameters.

Water Quality Geographic Analysis Area: Coastal Marine Waters

This section presents water quality data for federal waters, mostly associated with the Lease Area, and offshore waters for the ECCs. Energy will be transmitted from up to five OSPs to landfall sites utilizing up to two ECCs that include one preferred route to Brayton Point, Massachusetts (Brayton Point ECC) and one variant route to Falmouth, Massachusetts (Falmouth ECC).[1] The Falmouth ECC state waters include Nantucket Sound, which is located between the south coast of Massachusetts and the Islands of Martha's Vineyard and Nantucket. The Brayton Point ECC state waters include the Sakonnet River, located east of Narragansett Bay in Rhode Island which connects Mount Hope Bay to the Rhode Island Sound. Mount Hope Bay is located between both Massachusetts and Rhode Island and is in the vicinity of the proposed export cable landfall locations at Brayton Point. Water quality of coastal marine waters in the geographic analysis area are summarized below, with more detailed water quality information included in COP Appendix H (SouthCoast Wind 2024).

Federal Waters in the Geographic Analysis Area: Water quality data collected by the Northeast Fisheries Science Center (NEFSC) from 1963 to 2019 show that yearly surface water temperature averages ranged from approximately 41.4°F (5.2°C) to 61.7°F (16.5°C), while bottom water temperatures ranged from approximately 44.4°F (6.9°C) to 54.9°F (12.7°C). Salinity averages remained fairly stable; ranging only from approximately 32.7 practical salinity units (psu) to 32.9 psu at the surface and from approximately 33.3 to 33.5 psu near the bottom (COP Appendix H; SouthCoast Wind 2024).

Long-term water temperature data are also available from the NOAA National Data Buoy Center (NDBC) for two buoys located in federal waters in the general vicinity of the Offshore Project area. Station 44020 is located in Nantucket Sound at a water depth of 46.9 feet (14.3 meters) near the Falmouth ECC.

[1] As described in Chapter 2, Section 2.1.2, *Alternative B – Proposed Action,* Brayton Point is the preferred ECC for both Project 1 and Project 2, and Falmouth is the variant ECC for Project 2, which would be used if SouthCoast Wind is prevented from using Brayton Point for Project 2.

Station 44097 is located near Block Island at a water depth of 158 feet (48.2 meters) near the Brayton Point ECC and the Lease Area. Data from 2009 through 2019 from the NDBC show that annual temperatures near the Falmouth ECC ranged from 39.0 F (3.9°C) to 69.6°F (20.9°C), while temperatures ranged from 45.7°F (7.6°C) to 67.3°F (19.6°C) near the Brayton Point ECC and Lease Area (COP Appendix H; SouthCoast Wind 2024).

Falmouth ECC State Waters in the Geographic Analysis Area: The Center for Coastal Studies (CCS) began monitoring the water quality of the coastal waters of Cape Cod in 2006, and its program includes the only water quality monitoring that is regularly conducted in Nantucket Sound. Four sampling locations within Nantucket Sound are located in the general vicinity of the Falmouth ECC. Data collected from these stations are available from 2010 to 2016. Four sampling locations within Nantucket Sound are in the general vicinity of the Falmouth ECC. Data collected from these stations are available from 2010 to 2016. Three sampling stations are in coastal areas in the vicinity of the export cable landfall location in Falmouth. Data collected from these stations are available from 2014 to 2016 (CCS 2020). A sampling station at Oyster Pond-Falmouth is located near the alternate landfall locations. Table 3.4.2-1 and Table 3.4.2-2 present the seasonal results for the Nantucket Sound and coastal sampling stations, respectively. Winter sampling data were not available. Average seasonal results are summarized for water temperature, salinity, dissolved oxygen, chlorophyll *a*, turbidity, total nitrogen, and total phosphorus.

Table 3.4.2-1. Mean and standard deviation for water quality parameters measured in Nantucket Sound by CCS (2010–2016)

Season	Water Temperature (°C)	Salinity (psu)	DO (mg/L)	Chlorophyll *a* (µg/L)	Turbidity (NTU)	Total Nitrogen (µm)	Total Phosphorus (µm)
Spring (n=27)	12.9 ± 2.3	32.1 ± 0.25	9.8 ± 1.1	1.2 ± 0.53	0.47 ± 0.31	10.1 ± 3.5	0.61 ± 0.27
Summer (n=142)	20.5 ± 2.4	31.5 ± 1.4	7.6 ± 0.75	1.9 ± 0.83	0.59 ± 0.46	11.7 ± 4.8	0.71 ± 0.31
Fall (n=83)	18.2 ± 3.0	31.9 ± 0.25	7.7 ± 0.58	2.2 ± 1.1	0.51 ± 0.37	10.4 ± 3.1	0.76 ± 0.22

Source: COP Appendix H; SouthCoast Wind 2024.
Results show mean ± 1 standard deviation; n= number of samples (not all samples were analyzed for all parameters).
Spring = March to May; Summer = June to August; Fall = September to November.
n = number of samples (not all samples were analyzed for all parameters).

Table 3.4.2-2. Mean and standard deviation for water quality parameters measured in coastal locations near Falmouth Cable Landfall(s) by CCS (2014–2016)

Season	Water Temperature (°C)	Salinity (psu)	DO (mg/L)	Chlorophyll *a* (µg/L)	Turbidity (NTU)	Total Nitrogen (µm)	Total Phosphorus (µm)
Spring (n=10)	18.4 ± 1.3	21.1 ± 13.3	7.0 ± 1.3	5.4± 2.2	2.2± 1.1	Not sampled	Not sampled
Summer (n=62)	24.1 ± 2.5	21.2 ± 12.6	6.7 ± 1.8	10.0 ± 6.3	2.3 ± 1.5	35.0 ± 12.5	1.4 ± 0.58
Fall (n=33)	19.2 ± 4.1	21.8 ± 12.6	7.2 ± 2.0	13.0 ± 12.8	2.8 ± 3.0	42.3 ± 21.5	1.4 ± 0.82

Source: COP Appendix H; SouthCoast Wind 2024.
Results show mean ± 1 standard deviation; n= number of samples (not all samples were analyzed for all parameters).
Spring = March to May; Summer = June to August; Fall = September to November.
n= number of samples (not all samples were analyzed for all parameters).

The condition of coastal water was assessed by USEPA in the 2010 National Coastal Condition Assessment (NCCA) (USEPA 2015). Water quality data from the 2010 NCCA are available for eight stations within Nantucket Sound. Parameters measured in this assessment included chlorophyll *a*, dissolved inorganic nitrogen, dissolved inorganic phosphorus, DO at the bottom of the water column, and light transmissivity. Water quality results for the Nantucket Sound data set are summarized in Table 3.4.2-3. These water quality parameters were used to determine a water quality index (WQI) for each sample characterized as Good, Fair, or Poor. As summarized in Table 3.4.2-4, in Nantucket Sound, 88 percent of the samples (seven of eight) received a WQI of Good and the remaining sample was Fair.

Table 3.4.2-3. Mean and standard deviation for water quality parameters in Nantucket Sound measured in the 2010 NCCA

Season	Chlorophyll *a* (µg/L)	Dissolved Inorganic Nitrogen (mg/L)	Dissolved Inorganic Phosphorus (mg/L)	DO (mg/L)	Light Transmissivity (% at 1 m depth)
Nantucket Sound (n=8)	18.4 ± 1.3	21.1 ± 13.3	7.0 ± 1.3	5.4± 2.2	2.2± 1.1

Source: COP Appendix H; SouthCoast Wind 2024.
Results show mean ± 1 standard deviation; n= number of samples (not all samples were analyzed for all parameters).

Table 3.4.2-4. Summary of surface water parameter scores and WQI for the Nantucket Sound

Parameter	Good	Fair	Poor	No Data
Chlorophyll *a*	88%	12%	0%	0%
Dissolved inorganic nitrogen	100%	0%	0%	0%
Dissolved inorganic phosphorus	0%	100%	0%	0%
Dissolved oxygen	88%	12%	0%	0%
Light transmissivity	75%	0%	0%	25%
Overall WQI	88%	12%	0%	0%

Source: COP Appendix H; SouthCoast Wind 2024.
Results show percent of samples within each category for individual parameters and overall WQI.

Brayton Point ECC State Waters: Data was collected by the United States Geological Survey at a buoy monitoring station in the Sakonnet River near Gould Island, Rhode Island. The Sakonnet River remains saline throughout the year due to tidal influence. Reaching peak temperatures in the summer months, the river also reaches its lowest DO (Table 3.4.2-5). Seasonal algal growth, seen as increased Chlorophyll *a*, as well as low DO levels have raised concern for the ecological health of the river. The primary causes of the observed water-quality impairments are the inputs of nutrients from wastewater management and stormwater runoff from the surrounding developed area (COP Appendix H; SouthCoast Wind 2024).

Table 3.4.2-5. Mean and standard deviation for water quality parameters measured from the USGS Sakonnet River Station Buoy near Gould Island, Rhode Island (2018–2019)

Season	Water Temperature (°C)	Salinity (psu)	DO (mg/L)	Chlorophyll *a* (µg/L)	Turbidity (NTU)	Total Nitrogen (µm)	Total Phosphorus (µm)
Spring (n=2)	12.6 ± 0.2	28 ± 0.0	7.3 ± 0.4	NA	1.2± 0.0	0.21 ± 0.03	0.04 ±0.01
Summer (n=28)	22.3 ± 2.7	30.3 ± 0.8	6.1 ± 0.9	6.3 ± 4.6	2.4 ± 0.8	0.28 ± 0.07	0.07 ± 0.02
Fall (n=20)	17.7 ± 4.7	29.8 ± 1.2	7.0 ± 1.0	3.0 ± 1.4	2.5 ± 0.6	0.33 ± 0.08	0.08 ± 0.01

Source: COP Appendix H; SouthCoast Wind 2024.
Results show mean ± 1 standard deviation; n = number of samples (not all samples were analyzed for all parameters).
Values for turbidity and salinity were only measured in 2018.
Spring = March to May; Summer = June to August; Fall = September to November.

The Massachusetts Department of Environmental Protection (MassDEP) operates two fixed-location buoys at the mouths of the Cole and Taunton Rivers to monitor water quality in Mount Hope Bay seasonally from May to November. The monitoring is part of the Narragansett Bay Fixed-Site Monitoring Network (NBFSMN) and provides data in the Massachusetts portion of Mount Hope Bay. Data collected from these stations are available for the 2017 and 2018 seasons as shown in Table 3.4.2-6 (COP Appendix H; SouthCoast Wind 2024).

Table 3.4.2-6. Mean and standard deviation for water quality parameters measured in Mount Hope Bay by NBFSMN (2017–2018)

Year	Site	Water Temperature (°C)	Salinity (psu)	DO (mg/L)	Chlorophyll *a* (RFU)	Nitrate-N (mg/:)
2017	Taunton Buoy	20.3 ± 3.2	27.4 ± 1.2	7.4 ± 1.3	2.5 ± 2.2	0.12 ± 0.06
	Cole Buoy	20.5 ± 3.3	27.9 ± 1.9	7.9 ± 1.3	4.3 ± 3.7	0.13 ± 0.06
2018	Taunton Buoy	21.3 ± 4.3	27.2 ± 2.6	7.1 ± 1.2	2.7 ± 2.2	0.18 ± 0.08
	Cole Buoy	21.4 ± 4.4	27.5 ± 2.1	7.5 ± 1.2	2.7 ± 2.0	0.16 ± 0.06

Source: COP Appendix H; SouthCoast Wind 2024.
Results show mean ± 1 standard deviation.

A buoy located near the proposed Brayton Point landfall site(s) and the Brayton Point ECC is located in Mount Hope Bay. Table 3.4.2-7 summarizes the temperature data between 2011 and 2020 (COP Appendix H; SouthCoast Wind 2024).

Table 3.4.2-7. Mean and standard deviation for seasonal water temperature data from NOAA NDBC for Mount Hope Bay (2011–2020)

Season	Number of Samples	Water Temp (°C)
Spring	210,308	9.4 ± 4.2
Summer	207,469	22.7 ± 2.8
Fall	207,819	16.5 ± 4.8
Winter	209,750	4.5 ±2.5

Source: COP Appendix H; SouthCoast Wind 2024.
Results show mean ± 1 standard deviation.
Spring = March to May; Summer = June to August; Fall = September to November, Winter = December to February.

303(d) Listed Impaired Waters: Assessment units listed as 303(d) impaired in the water quality geographic analysis area include, but are not limited to, Buzzards Bay, Outer New Bedford Harbor, New Bedford Inner Harbor, Mount Hope Bay, Upper Narragansett, Providence River, Newport Harbor/Coddington Cove, Bear Creek, Middle Harbor, and associated tidal tributaries. These waters are non-attaining for fish consumption, ecological or recreational use, with causes including metals other than mercury, nutrients, oil and grease, trash, pathogens, total toxins, oxygen depletion, and PCBs (USEPA 2020).

Water Quality Specific to Proposed Ports

SouthCoast Wind is considering multiple ports for construction including New Bedford, Fall River, and Salem, Massachusetts; Davisville and Providence, Rhode Island; New London, Connecticut; Sparrows Point, Maryland; Charleston, South Carolina; and Corpus Christi, Texas as well as some international ports. O&M vessel trips would originate primarily from the ports of New Bedford and Fall River, Massachusetts; New London, Connecticut; or Providence, Rhode Island with the potential for occasional repair and supply delivery trips originating from ports in Davisville and Providence, Rhode Island; Salem, Massachusetts; Sparrows Point, Maryland; and Charleston, South Carolina..

USEPA (2012) assessed water quality conditions along the coasts of the United States and developed a WQI (good, fair, or poor) that evaluated five water quality parameters: nitrogen, phosphorus, chlorophyl *a*, water clarity (TSS or turbidity), and DO. The overall water quality condition of the Northeast Coast, which includes the proposed ports in Connecticut, Maryland, Massachusetts, and Rhode Island, is considered fair, with 9 percent of the coastal area rated poor and 53 percent rated fair. Phosphorus, chlorophyll *a*, DO, and water clarity ratings are all considered fair, while nitrogen rating is considered good (USEPA 2012). The overall water quality condition of the Southeast Coast, which includes the proposed port in South Carolina, is considered fair, with 13 percent of the coastal area rated poor and 64 percent of the area rated fair. Ratings for phosphorus, chlorophyll *a*, and DO are all considered fair, and the rating for nitrogen is considered good. Water clarity has a poor rating. The Gulf Coast, which includes the proposed port in Texas, has an overall water quality rating of fair, with 10 percent of the coastal area being rated poor and 53 percent of the area rated fair. Water quality ratings for nitrogen and DO are considered good, while ratings for phosphorus, chlorophyll *a*, and water clarity are considered fair.

303(d) Listed Impaired Waters: Assessment units listed as 303(d) impaired in the water quality geographic analysis area relative to proposed ports in Connecticut, Maryland, Massachusetts, and Rhode Island include, but are not limited to, Salem Harbor, Plum Island Sound, New Bedford Inner Harbor, Mount Hope Bay, Bear Creek, Middle Harbor, LIS EB Midshore – Stonington, LIS EB Shore – Wequetequock Cove, Stonington, LIS EB Inner – Pawcatuck River (02), Stonington, LIS EB Inner – Inner Wequetequock Cove, Stonington, Tidal Pawcatuck River, Thames River (Mouth), New London, LIS EB Inner – Thames River (middle), Ledyard and associated tidal tributaries. Impaired assessment units in the water quality geographic analysis area relative to proposed ports in South Carolina and Texas include, but are not limited to, Gulf of Mexico, Corpus Christi Inner Harbor, Laguna Madre, and Oso Bay. These waters are non-attaining for fish consumption, ecological, or recreational use, with causes including algal growth, unknown impaired biota, pathogens, and oxygen depletion (USEPA 2020).

Water Quality Geographic Analysis Area: Coastal Onshore Waters

As previously stated, surface waters within most of the geographic analysis area and all of the Onshore Project areas are coastal marine waters. The Falmouth underground export cable and transmission routes pass several small coastal ponds between the preferred and alternate export cable landfall locations and the onshore substation sites. The onshore export cable and alternate underground transmission routes do not cross any mapped rivers, streams, vernal pools, or waterbodies, but do pass within 0.6 mile (1 kilometer) of Cape Cod Canal, Great Pond, Grews Pond, and Long Pond. The underground onshore export cable routes between the preferred and alternate landfall locations and the onshore substation sites pass through residential areas containing small coastal ponds including Salt Pond, Sols Pond, Jones Pond, Grews Pond, Siders Pond, Shivericks Pond, an unnamed pond north of Shivericks Pond, Nyes Pond, and Morse Pond. The Falmouth onshore export cables do not cross any streams designated as impaired. One impaired waterbody, Little Pond, is adjacent to a Falmouth onshore export cable segment. The Little Pond assessment unit is non-supporting for ecological use and fish consumption caused by pathogens, and unknown causes.

The Brayton Point export cable corridor crosses over Aquidneck Island in route to the Brayton Point landfall locations. As the export cable crosses over Aquidneck Island it passes through residential and recreational areas. There are several freshwater streams and ponds present in the vicinity of the onshore export cable route options, including Founders Brook, which is listed as impaired. Founders Brook is non-supporting for recreational use due to pathogens. Numerous estuaries are also within the vicinity of the onshore export cable routes, including Old Orchard Cove, Long Neck Cove, and Mount Hope Bay. The assessment units listed as impaired within the geographic analysis area of the Brayton Point onshore cable routes include the Sakonnet River and Mount Hope Bay. The Sakonnet River assessment unit is non-attaining for fish consumption use caused by pathogens and unknown causes. The Mount Hope Bay assessment unit is non-attaining for ecological use and fish consumption use caused by nutrients, oxygen depletion, pathogens, and unknown causes.

Groundwater Quality

Several drinking water protection areas occur in the vicinity of the Falmouth transmission line and underground cable routes. These include multiple Zone I and Zone II Wellhead Protection areas, as well as surface water supply protection areas primarily surrounding Long Pond (COP Appendix H, Section 3.4.4.1, Figure 3-6; SouthCoast Wind 2024). The USGS has investigated groundwater and surface water resources on Cape Cod for over 50 years. Groundwater is the sole source of drinking water and a major source of freshwater for domestic, industrial, and agricultural uses on the Cape. Groundwater discharged from aquifers also supports freshwater pond and stream ecosystems and coastal wetlands. In most areas, groundwater in the sand and gravel aquifers is shallow and susceptible to contamination from anthropogenic sources and saltwater intrusion. USGS activities include long-term monitoring of groundwater and pond levels and field research on groundwater contamination and plumes associated with Joint Base Cape Cod (JBCC), located north of the Falmouth Onshore Project area. Groundwater quality data in the vicinity of the Falmouth Onshore Project area were not identified (SouthCoast Wind 2024).

The Rhode Island Department of Environmental Management (RIDEM) classifies the groundwater quality of the area surrounding the Brayton Point onshore export cable route options over Aquidneck Island as Class GA, which includes groundwater resources that are known or presumed to be suitable for drinking water use without treatment. However, the Aquidneck Island area is not considered a priority area (GAA classification), and approximately 70 percent of the state of Rhode Island overlies groundwater classified as GA. There are no drinking water protection areas (e.g., public wells, well head protection areas, drinking water reservoir watersheds) along the Brayton Point ECC. This includes the overland portion on Aquidneck Island (COP Appendix H, Section 3.4.4.1, Figure 3-6; SouthCoast Wind 2024). Brayton Point is home to considerable past and former industrial use, and there has been past contamination identified in the groundwater. Even though there are no drinking water aquifers identified at the landing sites, data provided in the *2019 Annual Groundwater Monitoring and Corrective Action Report and Final Closure Report - Brayton Point CCR Basins A, B, and C* suggests that groundwater will be less than 6 feet (1.8 meters) below the ground surface at the landing sites (GEI Consultants 2019).

3.4.2.2 Impact Level Definitions for Water Quality

Definitions of potential impact levels are provided in Table 3.4.2-8. There are no beneficial impacts on water quality.

Table 3.4.2-8. Impact level definitions for water quality

Impact Level	Impact Type	Definition
Negligible	Adverse	Changes would be undetectable.
Minor	Adverse	Changes would be detectable but would not result in degradation of water quality in exceedance of water quality standards.
Moderate	Adverse	Changes would be detectable and would result in localized, short-term degradation of water quality in exceedance of water quality standards.
Major	Adverse	Changes would be detectable and would result in extensive, long-term degradation of water quality in exceedance of water quality standards.

3.4.2.3 Impacts of Alternative A – No Action on Water Quality

When analyzing the impacts of the No Action Alternative on water quality, BOEM considered the impacts of ongoing activities, including ongoing non-offshore wind and ongoing offshore wind activities on the baseline conditions for water quality. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities, as described in Appendix D, *Planned Activities Scenario*.

Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for water quality described in Section 3.4.2.1, *Description of the Affected Environment and Future Baseline Conditions*, would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities. Ongoing activities within the geographic analysis area that contribute to impacts on water quality generally relate to or include terrestrial runoff, ground disturbance (e.g., construction) and erosion, terrestrial point and non-point source discharges, and atmospheric deposition. The deposition of contaminated runoff into surface waters and groundwater can result in exceedances of water quality standards that can affect the beneficial uses of the water (e.g., drinking water, aquatic life, recreation). While water quality impacts may be temporary and localized (e.g., construction), and state and federal statutes, regulations and permitting requirements (e.g., Clean Water Act Section 402) avoid or minimize these impacts, issues with water quality can still persist.

Ongoing offshore wind activities in the geographic analysis area that contribute to impacts on water quality include ongoing construction of the Vineyard Wind 1 project (62 WTGs and 1 OSP) in OCS-A 0501, the South Fork project (12 WTGs and 1 OSP) in OCS-A 0517, and the Revolution Wind project (65 WTGs and two OSPs) in OCS-A 0486. Ongoing construction of these projects would affect water quality through the primary IPFs of accidental releases, anchoring, new cable emplacement and maintenance, port utilization, presence of structures, discharges/intakes, and land disturbance. Ongoing construction of the Vineyard Wind 1, South Fork, and Revolution Wind projects would have the same type of impacts on water quality that are described in *Cumulative Impacts of the No Action Alternative* for ongoing and planned offshore wind activities, but the impacts would be of lower intensity.

Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative in combination with other planned non-offshore wind activities and planned offshore wind activities (without the Proposed Action).

Other planned non-offshore wind activities that affect the water quality include onshore development activities (including urbanization, forestry practices, municipal waste discharges, and agriculture), marine transportation-related discharges, dredging and port improvement projects; commercial fishing, military use, new submarine cables and pipelines, and climate change (see Appendix D, *Planned Activities Scenario,* Section D.2 for a description of planned activities). Water quality impacts from these activities, especially from dredging and harbor, port, and terminal operations, are expected to be localized and temporary to permanent, depending on the nature of the activities and associated IPFs. Similar to ongoing activities, the deposition of contaminated runoff into surface waters and groundwater can result in exceedances of water quality standards that can affect the beneficial uses of the water (e.g., drinking water, aquatic life, recreation). State and federal water quality protection requirements and permitting would result in avoiding and minimizing these impacts.

The following sections summarize the potential impacts of ongoing and planned offshore wind activities in the geographic analysis area on water quality during construction, O&M, and decommissioning of the projects. The water quality geographic analysis area overlaps with most, but not all, of the Vineyard Wind Northeast (OCS-A 0522) and the Beacon Wind 1 (OCS-A 0520) lease areas. The geographic analysis area also has some overlap with the remainder of the lease areas in the Massachusetts/Rhode Island region. BOEM conservatively assumed in its analysis of water quality impacts that all 1,048 WTGs estimated for the Massachusetts/Rhode Island region lease areas would be sited within the water quality geographic analysis area. BOEM anticipates that there would be some construction overlap for offshore project components of these lease areas (Appendix D, Table D3-1).

BOEM expects offshore wind activities to affect water quality through the following primary IPFs.

Accidental releases: Other offshore wind activities could expose surface waters to contaminants (such as fuel, solid waste, or chemicals, solvents, oils, or grease from equipment) in the event of a spill or release during routine vessel use. Offshore wind projects would result in a small incremental increase in vessel traffic, with a short-term peak during construction. Vessel activity associated with construction is expected to occur regularly in the Massachusetts and Rhode Island lease areas beginning in 2023 and continuing through 2030 and then lessen to near-baseline levels during operational activities. Increased vessel traffic would be localized near affected ports and offshore construction areas. Increased vessel traffic in the region associated with offshore wind construction could increase the probability of collisions and allisions, which could result in oil or chemical spills.

Based on the estimated construction schedules (Appendix D, Table D-2), offshore wind projects could occur with some overlapping construction schedules between 2023 and 2030. This EIS estimates that up to approximately 1,833,481 gallons (8,335,170 liters) of coolants, 6,835,448 gallons (31,073,946 liters) of oils, and 1,729,064 gallons (7,860,324 liters) of diesel fuel could be stored within WTG foundations and the OSPs in the water quality geographic analysis area. Other chemicals, including grease, paints, and sulfur hexafluoride, would also be used at the offshore wind projects, and black and gray water may be stored in sump tanks on facilities. BOEM has conducted extensive modeling to determine the likelihood and effects of a chemical spill at offshore wind facilities at three locations along the Atlantic Coast, including an area near the proposed Project area (Rhode Island-Massachusetts Wind Energy Area [WEA]) (Bejarano et al. 2013). Results of the model indicated a catastrophic, or maximum-case scenario, release of 129,000 gallons (488,318 liters) of oil mixture has a "Very Low" probability of occurring, meaning it could occur one time in 1,000 or more years. In other words, the likelihood of a given spill resulting in a release of the total container volume (such as from a WTG, OSP, or vessel) is low. The modeling effort also revealed the most likely type of spill (i.e., non-routine event) to occur is from the WTGs at a volume of 90 to 440 gallons (341 to 1,666 liters), at a rate of one time in 1 to 5 years, or a diesel fuel spill of up to 2,000 gallons (7,571 liters) at a rate of one time in 20 years. The likelihood of a spill occurring from multiple WTGs and OSPs at the same time is very low and, therefore, the potential impacts from a spill larger than 2,000 gallons (7,571 liters) are largely discountable. The modeling effort was conducted based on information collected from multiple companies and projects and would therefore apply to the other projects in the water quality geographic analysis area. For the purposes of this discussion, small-volume spills equate to the most likely spill volume between 90 and 440 gallons (341 to 1,666 liters) of oil mixture or up to 2,000 gallons (7,571 liters) of diesel fuel, while large-volume spills are defined as a catastrophic release of 129,000 gallons (488,318 liters) of material, based on modeling conducted by Bejarano et al. (2013). Small-volume spills could occur during maintenance or transfer of fluids, while low-probability small- or large-volume spills could occur due to vessel collisions, allisions with the WTGs/OSPs, or incidents such as toppling during a storm or earthquake.

All offshore wind projects would be required to comply with regulatory requirements related to the prevention and control of accidental spills administered by USCG and BSEE. OSRPs are required for each project and would provide for rapid spill response, cleanup, and other measures that would help to minimize potential impacts on affected resources from spills. Vessels would also have their own onboard containment measures that would further reduce the impact of an allision. A release during construction or operation would generally be localized and short term and result in little change to water quality. In the unlikely event an allision or collision involving project vessels or components resulted in a large spill, impacts on water quality would be adverse and short term to long term, depending on the type and volume of material released and the specific conditions (e.g., depth, currents, weather conditions) at the location of the spill.

Accidental releases of trash and debris would be infrequent and negligible because operators would comply with federal and international requirements for management of shipboard trash. All vessels would also need to comply with the USCG ballast water management requirements outlined in 33 CFR 151 and 46 CFR 162; allowed vessel discharges such as bilge and ballast water would be restricted to uncontaminated or properly treated liquids.

In summary, there is potential for moderate water quality impacts due to a maximum scenario accidental release, but due to the very low likelihood of a maximum scenario release occurring and the expected size of the most likely spill to be small and of low frequency, the overall impact of accidental releases is anticipated to be short term, localized, and minor, resulting in little change to water quality. As such, accidental releases from offshore wind development in the water quality geographic analysis area would not be expected to contribute appreciably to overall impacts on water quality.

Anchoring: Offshore wind activities would contribute to changes in offshore water quality from resuspension and deposition of sediments from anchoring during construction, installation, maintenance, and decommissioning of offshore components. BOEM estimates that approximately 2,134 acres (864 hectares) of seabed could be affected by anchoring in the water quality geographic analysis area. Disturbances to the seabed during anchoring would temporarily increase suspended sediment and turbidity levels in and immediately adjacent to the anchorage area. The intensity and extent of the additional sediment suspension effects would be less than that of new cable emplacement (see new cable emplacement and maintenance IPF discussion below) and would therefore be unlikely to have an incremental impact beyond the immediate vicinity. If more than one project is being constructed during the same period, the impacts would be greater than for one project, and multiple areas would experience water quality impacts from anchoring but, due to the localized area for sediment plumes, the impacts would likely not overlap each other geographically. The overall impact of increased sediment and turbidity from vessel anchoring is anticipated to be adverse, localized, and short term, resulting in a minor impact on ambient water quality. Anchoring would not be expected to appreciably contribute to overall impacts on water quality.

New cable emplacement and maintenance: Emplacement of submarine cables would result in increased suspended sediments and turbidity. As described under the *Anchoring* IPF, these activities would contribute to changes in offshore water quality from the resuspension and deposition of sediment. Sediment dispersion modeling conducted for two other offshore wind projects (the Vineyard Wind 1 Project in Massachusetts and the Block Island Wind Farm in Rhode Island) were reviewed and evaluated, and general sediment conditions and hydrodynamics are similar to those in the Project area (COP Appendices F1 and F3 for detailed descriptions; SouthCoast Wind 2024). The sediments within each project area were predominantly sands and current velocities were within similar ranges, indicating that the results of each modeling effort would be expected to be representative of the Project site. Turbidity concentrations greater than 10 mg/L would be short in duration up to 6 hours and limited to within approximately 164 to 656 feet (50 to 200 meters) of the trench in the offshore area. BOEM anticipates that offshore wind projects would use dredging only when necessary and rely on other cable laying methods for reduced impacts (such as jet plow or mechanical plow) where feasible. Due to the localized areas of disturbances and range of variability within the water column, the overall impacts of increased sediments and turbidity from cable emplacement and maintenance are anticipated to be localized, short term, and adverse, resulting in a minor impact on ambient water quality. If multiple projects are being constructed at the same time, the impacts would be greater than those identified for one project and would likely not overlap each other geographically due to the localized natures of the plumes. New cable emplacement and maintenance activities would not be expected to appreciably contribute to overall impacts on water quality.

Port utilization: Offshore wind development would use nearby ports and could also require port expansion or modification, resulting in increased vessel traffic or increased suspension and turbidity from any in-water work. These activities could also increase the risk of accidental spills or discharge. However, these actions would be localized, and port improvements would comply with all applicable permit requirements to minimize, reduce, or avoid impacts on water quality. As a result, port utilization impacts on water quality would be minor and not be expected to appreciably contribute to overall impacts on water quality.

Presence of structures: Reasonably foreseeable offshore wind projects are estimated to result in approximately 920 structures by 2030 in the water quality geographic analysis area (Appendix D, Table D3-1). These structures could disturb up to 1,247 acres (505 hectares) of seabed in the water quality geographic analysis area from foundation and scour protection installation and disrupt bottom current patterns, leading to increased movement, suspension, and deposition of sediments. Scouring, which could lead to impacts on water quality through the formation of sediment plumes (Harris et al. 2011), would generally occur in shallow areas with tidally dominated currents.

Offshore wind facilities have the potential to impact atmospheric and oceanographic processes through the presence of structures and the extraction of energy from the wind. There has been extensive research into characterizing and modeling atmospheric wakes created by wind turbines in order to design the layout of wind facilities and hydrodynamic wake/turbulence related to predicting seabed scour but relatively few studies have analyzed the hydrodynamic wakes coupled with the interaction of atmospheric wakes with the sea surface. Further, even fewer studies have analyzed wakes and their impact on regional scale oceanographic processes and potential secondary changes to primary production and ecosystems. Studies thus far in this topic have focused on ocean modeling rather than field measurement campaigns.

The general understanding of offshore wind–related impacts on hydrodynamics is derived primarily from European based studies. A synthesis of European studies by van Berkel et al. (2020) summarized the potential effects of wind turbines on hydrodynamics, the wind field, and fisheries. Local to a wind facility, the range of potential impacts include increased turbulence downstream, remobilization of sediments, reduced flow inside wind farms, downstream changes in stratification, redistribution of water temperature, and changes in nutrient upwelling and primary productivity. Human-made structures, especially tall vertical structures such as foundations, alter local water flow at a fine scale by potentially reducing wind-driven mixing of surface waters or increasing vertical mixing as water flows around the structure (Carpenter et al. 2016; Cazenave et al. 2016; Segtnan and Christakos 2015). When water flows around the structure, turbulence is introduced that influences local current speed and direction. Turbulent wakes have been observed and modeled at the kilometer scale (Cazenave et al. 2016; Vanhellemont and Ruddick 2014). While impacts on current speed and direction decrease rapidly around monopiles, there is a potential for hydrodynamic effects out to a kilometer from a monopile (Li et al. 2014). Direct observations of the influence of a monopile extended to at least 984 feet (300 meters); however, changes were indistinguishable from natural variability in a subsequent year (Schultze et al. 2020). The range of observed changes in current speed and direction 984 to 3,281 feet (300 to 1,000 meters) from a monopile is likely related to local conditions, wind farm scale, and sensitivity of the analysis. In strongly stratified locations, the mixing seen at monopiles is often masked by processes forcing toward stratification (Schultze et al. 2020), but the introduction of nutrients from depth into the surface mixed layer can lead to a local increase in primary production (Floeter et al. 2017; refer to Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*, Section 3.5.6, *Marine Mammals*, and Section 3.5.7, *Sea Turtles*, regarding hydrodynamic and atmospheric wake effects on primary production).

Atmospheric wakes brought about by WTG structures may also result in impacts on the forces driving the mixing of surface waters. A modeling study of atmospheric wake effects by Daewel et al. (2022) showed that extremely large clusters of offshore wind turbines in the North Sea provoke large scale changes in annual primary productivity due to changes in stratification. Christiansen et al. (2022) determined that wake-induced anomalies in wind speed caused by North Sea wind farms could lead to a decrease in the shear-driven forcing at the sea surface boundary, which affects ocean stratification over several tens of kilometers around the wind farms. Water column impacts heavily depend on foundation type and oceanographic conditions (e.g., currents, well-mixed to stratified waters, and depth). Many of the modeling studies conducted to date note uncertainty in whether impacts observed in the models would be distinguishable relative to natural variability in oceanographic conditions (Schultze et al. 2020; Christiansen et al. 2022; Floeter et al. 2022; NASEM 2023). A recent National Academy of Sciences panel convened to assess potential impacts from offshore windfarms in the Nantucket Shoals region on marine hydrodynamics. The panel noted that "the paucity of observations and uncertainty of the modeled hydrodynamic effects make it difficult to assess the ecological impacts of offshore wind farms, particularly considering the scale of both natural and human-caused variability in the Nantucket Shoals region...." (NASEM 2024). While oceanographic and hydrodynamic conditions resulting from the presence of offshore structures are not fully understood at this time, the range of the wake effect may extend from a few hundred meters (Li et al. 2014; Schultze et al. 2020) to tens of kilometers (Dorrell et al. 2022, Christiansen et al. 2022) and is likely to vary both seasonally and regionally.

Results from a recent Johnson et al. (2021) hydrodynamic model of four different WTG build-out scenarios of the offshore Rhode Island and Massachusetts lease areas found that offshore wind projects have the potential to alter local and regional physical oceanic processes (e.g., currents, temperature stratification) via their influence on currents from WTG foundations and by extracting energy from the wind. The results of the hydrodynamic model study show that introduction of the offshore wind structures into the offshore WEA modifies the oceanic responses of current magnitude, temperature, and wave heights by (1) reducing the current magnitude through added flow resistance, (2) influencing the temperature stratification by introducing additional mixing, and (3) reducing current magnitude and wave height by extracting of energy from the wind by the offshore wind turbines. Alterations in currents and mixing would affect water quality parameters such as temperature, DO, and salinity, but would vary seasonally and regionally. WTGs and the OSPs associated with reasonably foreseeable offshore wind projects would be placed in average water depths of 100 to 200 feet (30 to 60 meters) where current speeds are relatively low, and offshore cables would be buried where possible. Cable armoring would be used where burial is not possible, such as in hard-bottomed areas. BOEM anticipates that developers would implement BMPs to minimize seabed disturbance from foundations, scour, and cable installation. Adverse impacts on offshore water quality would be localized, short term, and minor. Presence of structures would not be expected to appreciably contribute to overall impacts on water quality.

The exposure of offshore wind structures, which are mainly made of steel, to the marine environment can result in corrosion without protective measures. Corrosion is a general problem for offshore infrastructures and corrosion protection systems are necessary to maintain their structural integrity. Protective measures for corrosion (e.g., coatings, cathodic protection systems) are often in direct contact with seawater and have different potentials for emissions, e.g., galvanic anodes emitting metals, such as aluminum, zinc, and indium, and organic coatings releasing organic compounds due to weathering and leaching. The current understanding of chemical emissions for offshore wind structures is that emissions appear to be low, suggesting a low environmental impact, especially if compared to other offshore activities, but these emissions may become more relevant for the marine environment with increased numbers of offshore wind projects and a better understanding of the potential long-term effects of corrosion protection systems (Kirchgeorg et al. 2018). Based on the current understanding of offshore wind structure corrosion effects on water quality, BOEM anticipates the potential impact to be minor.

Discharges/intakes: Other offshore wind projects would result in a small incremental increase in vessel traffic, with a short-term peak during construction. Vessel activity associated with offshore wind project construction is expected to occur regularly in the Massachusetts and Rhode Island lease areas beginning in 2023 and continuing through 2030, and then lessen to near-baseline levels during operation. Increased vessel traffic would be localized near affected ports and offshore construction areas. Offshore wind development would result in an increase in regulated discharges from vessels, particularly during construction and decommissioning, but the events would be staggered over time and localized. Offshore permitted discharges would include uncontaminated bilge water and treated liquid wastes. BOEM assumes that all vessels operating in the same area will comply with federal and state regulations on effluent discharge. All offshore wind projects would be required to comply with regulatory requirements related to the prevention and control of discharges and of nonindigenous species. All vessels would need to comply with the USCG ballast water management requirements outlined in 33 CFR Part 151 and 46 CFR Part 162. Furthermore, each project's vessels would need to meet USCG bilge water regulations outlined in 33 CFR Part 151, and allowable vessel discharges such as bilge and ballast water would be restricted to uncontaminated or properly treated liquids. Therefore, due to the minimal amount of allowable discharges from vessels associated with offshore wind projects, BOEM expects impacts on water quality resulting from vessel discharges to be minimal and to not exceed background levels over time.

The WTGs and OSPs would continuously release chlorine and other waste heat during operation due to the heat transfer that occurs when seawater is used to cool the equipment that converts HVAC electricity to HVDC electricity. However, during normal operating conditions, the discharged chemicals and waste heat will have minimal impact on water quality if discharge concentrations meet the water quality-based limits of SouthCoast Wind's NPDES permit. In the event of a spill related to an allision or other unexpected or low-probability event, impacts on water quality from chemical discharges from the WTGs or OSPs during operation would be temporary. During decommissioning, all offshore wind structures would be drained of fluid chemicals via vessel, dismantled, and removed. BOEM does not anticipate any discharge of fluid chemicals in the ocean during the decommissioning of offshore wind structures. As such, BOEM anticipates decommissioning to have temporary impacts on water quality, with a return to baseline conditions.

Other offshore wind projects in the geographic analysis area may use HVDC substations that would convert AC to DC before transmission to onshore project components. As described in a recent white paper produced by BOEM (Middleton and Barnhart 2022), these HVDC systems are cooled by an open-loop system that intakes cool sea water and discharges warmer water back into the ocean. Chemicals such as bleach (sodium hypochlorite) would be used in order to prevent growth in the system and keep pipes clean. The warm water discharged is generally considered to have a minimal effect as it will be absorbed by the surrounding water and returned to ambient temperatures. Even though localized effects on water quality due to discharge of warmer water that contain bleach could take place in the area immediately surrounding the outlet pipe, they are expected to be minimal due to the much larger mass of the surrounding ocean if the facility meets the water quality-based discharge limits of SouthCoast Wind's NPDES permit. Potential impacts on water quality to surrounding sea water would require permits through the USEPA National Pollutant Discharge Elimination System (NPDES) (Middleton and Barnhart 2022).

Due to the staggered increase in vessels from various projects; the current regulatory requirements administered by USEPA, USACE, USCG, and BSEE; and the restricted allowable discharges, the overall impact of discharges from vessels is anticipated to be localized and short term. Based on the above, BOEM anticipates discharges to have a minor impact on water quality, as the level of impact in the water quality geographic analysis area from offshore wind development would be similar to existing conditions and would not be expected to appreciably contribute to overall impacts on water quality.

Land disturbance: Other offshore wind development could include onshore components that would lead to increased potential for water quality impacts resulting from accidental fuel spills or sedimentation during the construction and installation of onshore components (e.g., equipment, substation). Construction and installation of onshore components near waterbodies may involve ground disturbance, which could lead to unvegetated or otherwise unstable soils. Precipitation events could potentially erode the soils, resulting in sedimentation of nearby surface waters and subsequent increased turbidity. It is assumed that an SWPPP and erosion and sedimentation controls would likely be implemented during the construction period to minimize impacts, resulting in infrequent and temporary erosion and sedimentation events.

In addition, onshore construction and installation activities would involve the use of fuel and lubricating and hydraulic oils. Use of heavy equipment onshore could result in potential spills during active use or refueling activities. It is assumed that a Spill Prevention, Control, and Countermeasure (SPCC) plan would be prepared for each project in accordance with applicable regulatory requirements and would outline spill prevention plans and measures to contain and clean up spills if they were to occur. Additional mitigation and minimization measures (such as refueling away from wetlands, waterbodies, or known private or community potable wells) would be in place to decrease impacts on water quality. Impacts on water quality would be limited to periods of onshore construction and periodic maintenance over the life of each project.

Overall, the impacts from onshore activities that occur near waterbodies could result in temporary introduction of sediments or pollutants into coastal waters in small amounts where erosion and sediment controls fail. Land disturbance for offshore wind developments that are at a distance from waterbodies and that implement erosion and sediment control measures would be less likely to affect water quality. In addition, the impacts would be localized to areas where onshore components were being built near waterbodies. While it is possible that multiple projects could be under construction at the same time, the likelihood that construction of the onshore components overlaps in time or space is minimal, and the total amount of erosion that occurs and impacts on water quality at any one given time could be minimal. Land disturbance from offshore wind development is anticipated to be localized, short term, and minor, and would not be expected to appreciably contribute to overall impacts on water quality.

Conclusions

Impacts of the No Action Alternative: Under the No Action Alternative, water quality would continue to follow current regional trends and be affected by ongoing activities. BOEM expects ongoing non-offshore wind and offshore wind activities to have temporary impacts on water quality primarily through accidental releases and sediment suspension related to vessel traffic, port utilization, presence of structures, discharges, and land disturbance. BOEM anticipates that the impacts of ongoing activities, including construction of the Vineyard Wind 1 and South Fork projects, ongoing vessel traffic, military use, commercial activities, recreational activities, and land disturbance, would be **minor adverse**.

Cumulative Impacts of the No Action Alternative: Under the No Action Alternative, existing environmental trends and ongoing activities would continue to affect water quality in the geographic analysis area. Planned non-offshore wind activities, including new submarine cables and pipelines, onshore development, marine surveys, and port improvements, would incrementally contribute to cumulative impacts on water quality. Similarly, planned offshore wind projects would also contribute to water quality impacts from sediment resuspension during construction and decommissioning, both from regular cable laying and from prelaying; vessel discharges; sediment contamination; discharges from the WTGs and OSP during operation; sediment plumes due to scour; and erosion and sedimentation from onshore construction. Construction and decommissioning activities associated with planned offshore wind activities would lead to increases in sediment suspension and turbidity in the offshore lease areas during the first 7 years of construction of projects and in the latter part of the 30-year life spans of offshore wind projects due to decommissioning activities. However, sediment suspension and turbidity increases would be temporary and localized, and BOEM anticipates the impact to be minor. BOEM has considered the possibility of impacts resulting from accidental releases; a moderate impact could occur if there was a large-volume, catastrophic release. However, the probability of catastrophic release occurring is very low and the expected size of the most likely spill would be very small and of low frequency. Therefore, the cumulative impacts of the No Action Alternative on water quality from ongoing and planned activities would be **minor** because any potential detectable impacts are not anticipated to exceed water quality standards.

3.4.2.4 Relevant Design Parameters and Potential Variances in Impacts

This EIS analyzes the maximum-case scenario; any potential variances in the proposed Project build-out as defined in the PDE would result in impacts similar to or less than those described in the sections below. The following proposed Project design parameters (Appendix C, *Project Design Envelope and Maximum-Case Scenario*) would influence the magnitude of the impacts on water quality.

- The amount of vessel use during installation, operations, and decommissioning.
- The number of WTGs and OSPs and the amount of cable laid determines the area of seafloor and volume of sediment disturbed by installation.
- Installation methods chosen and the duration of installation.
- Proximity to sensitive water sources and mitigation measures used for onshore proposed Project activities.
- In the event of a non-routine event such as a spill, the quantity and type of oil, lubricants, or other chemicals contained in the WTGs, vessels, and other proposed Project equipment.

Variability of the proposed Project design as a result of the PDE includes the exact number of WTGs and OSPs (determining the total area of foundation footprints); the number of monopile, piled-jacket, or suction-bucket foundations; the total length of interarray cable; the total area of scour protection needed; and the number, type, and frequency of vessels used in each phase of the proposed Project. Changes in the design may affect the magnitude (number of structures and vessels), location (WTG and other Project element layouts), and mechanism (installation method, non-routine event) of water quality impacts.

SouthCoast Wind has committed to measures to minimize impacts on water quality. See COP Volume 2, Table 16.1 for a complete list of avoidance, minimization, and mitigation measures (AMMs) proposed for use during construction, O&M, and decommissioning of the Project (SouthCoast Wind 2024).

3.4.2.5 Impacts of Alternative B – Proposed Action on Water Quality

The Proposed Action would contribute to impacts through all the IPFs named in Section 3.4.2.3, *Offshore Wind Activities (without Proposed Action)*. The most impactful IPFs would likely include new cable emplacement and maintenance that could cause noticeable temporary impacts during construction through increased suspended sediments and turbidity, the presence of structures that could result in alteration of local water currents and lead to the formation of sediment plumes, and discharges that could result in localized turbidity increases during discharges or bottom disturbance during dredged material disposal.

Accidental releases: Similar to offshore wind projects without the Proposed Action, chemicals (e.g., coolants, oils, diesel fuel, other chemicals) would be used and stored in facilities and black and gray water may be stored in sump tanks on facilities. The Proposed Action would have a maximum of 75,000 gallons (283,905 liters) of coolants, 1,188,650 (4,499,527 liters) of oils and lubricants, and

332,300 gallons (1,257,891 liters) of diesel stored within WTG foundations and OSPs (COP Volume 1, Section 3.3.17, Table 3-26; SouthCoast Wind 2024). As discussed previously, the risk of a spill from any single offshore structure would be low, and any effects would likely be localized. A reduction in the number of WTGs required due to increased capacity would result in a smaller total amount of materials being stored offshore. Modeling conducted for an area near the proposed Project area (Rhode Island-Massachusetts WEA) indicates that the most likely type of spill (i.e., non-routine event) to occur during the life of a project is 90 to 440 gallons (341 to 1,666 liters), which would have brief, localized impacts on water quality (Bejarano et al. 2013). One difference between the Proposed Action and the Rhode Island-Massachusetts WEA is that there would be more WTGs under the Proposed Action (147 instead of 130 that were modeled), which would lead to a slight increased likelihood of spill events compared to the Bejarano et al. model (Bejarano et al. 2013). There is potential for moderate water quality impacts due to a maximum-case scenario accidental release, but due to the very low likelihood of a maximum-case scenario release occurring and the expected size of the most likely spill to be small and of low frequency, the overall impact is anticipated to be short term, localized, and minor, resulting in little change to water quality.

Increased vessel traffic in the region associated with the Proposed Action could increase the probability of collisions and allisions, which could possibly result in oil or chemical spills. However, collisions and allisions are anticipated to be unlikely based on the following factors that would be considered for the proposed Project: USCG requirement for lighting on vessels, NOAA vessel speed restrictions, the proposed spacing of WTGs and OSP, the lighting and marking plan that would be implemented, and the inclusion of proposed Project components on navigation charts. SouthCoast Wind would implement its OSRP (COP Appendix AA; SouthCoast Wind 2024), which would provide for rapid spill response, cleanup, and other measures to minimize any potential impact on affected resources from spills and accidental releases, including spills resulting from catastrophic events. In the unlikely event an allision or collision involving vessels or components associated with the Proposed Action resulted in a large spill, impacts from the Proposed Action alone on water quality would be short term to long term depending on the type and volume of material released and the specific conditions (e.g., depth, currents, weather conditions) at the location of the spill. In addition, SouthCoast Wind has committed to developing a Project-specific SPCC plan in the SWPPP to prevent accidental releases of oils and other hazardous materials to the extent practical (COP Volume 2, Table 16-1; SouthCoast Wind 2024). With implementation of this measure, risk of fuel spills and leaks from vessels would be minimized and any impact would be considered minor.

Onshore construction activities would require heavy equipment use or HDD activities, and potential spills could occur as a result of an inadvertent release from the machinery or during refueling activities. In addition, all wastes generated onshore would comply with applicable federal regulations, including the Resource Conservation and Recovery Act and the Department of Transportation Hazardous Material regulations. Therefore, BOEM anticipates the Proposed Action would result in minor, temporary, and long-term impacts on water quality as a result of releases from heavy equipment during construction and other cable installation activities.

SouthCoast Wind anticipates the Port of New Bedford's MCT as the primary port to be used for Project activities. The New Bedford MCT has been expanded to accommodate offshore wind projects. Further investments in port upgrades and general infrastructure improvements at the New Bedford MCT site and/or other ports in the region are expected in the future. SouthCoast Wind would also use the ports of Fall River and Salem, Massachusetts; Davisville and Providence, Rhode Island; and New London, Connecticut; a small number of vessel trips may also originate from the ports of Sparrows Point, Maryland; Charleston, South Carolina; and Corpus Christi, Texas. BOEM anticipates that use of the port facilities would result in minor impacts on water quality because a potential release at the facility would likely be relatively small and would be cleaned up in accordance with federal and state regulations.

Anchoring: There would be increased vessel anchoring during the construction, installation, O&M, and decommissioning of offshore components of the Proposed Action. Anchoring would cause increased turbidity levels. Impacts on water quality from the Proposed Action alone due to anchoring would be localized, short term, and minor during construction and decommissioning. SouthCoast Wind anticipates daily averages of between 15 and 35 vessels depending upon the construction activities, with an expected maximum of 50 vessels in the Lease Area at one time. The number of vessels is anticipated to result in 441.8 acres (178.8 square kilometers) of impact from anchoring. Anchoring during operation would decrease due to fewer vessels required during operation, resulting in reduced impacts.

Cable emplacement and maintenance: The installation of array cables and offshore export cables would include site-preparation activities (e.g., sandwave clearance, boulder removal) and cable installation via jet plow, mechanical plow, or mechanical trenching, which can cause temporary increases in turbidity and sediment resuspension. Other projects using similar installation methods (e.g., jet plowing, pile driving) have been characterized as having minor impacts on water quality due to the short-term and localized nature of the disturbance (Latham et al. 2017). To evaluate the impacts of offshore export cable and interarray cable installation, a sediment transport model was developed to evaluate potential suspended sediment transport and deposition (COP Appendix F3; SouthCoast Wind 2024). Results of the sediment dispersion modeling indicated that the water column concentration (TSS) and the sediment deposition pattern and thickness were mostly influenced by properties of the trench sediments (i.e., grain size distribution) disturbed during the jet trenching operations and localized current velocities. The dimensions of the trench, the advance rate, and the loss rate (a conservative loss rate of 25 percent representative of the jetting or mechanical trenching and 100 percent for the HDD pit dredging) to the water column, specified the total amount of sediments resuspended. The response was short lived for all but the finest grade sediments such as silts and clays. The fine sediments settle more slowly than coarser sediments resulting in the suspended silt and clay sediments being transported farther with the tidal currents than coarser sediments, increasing higher water column concentrations and durations of plumes. The Mount Hope Bay and the Sakonnet River segments, where higher portions of silt and clay are found in the sediments, exhibit this impact. The higher-level concentrations (100 mg/L and up) were somewhat contained in the Sakonnet River but covered a larger area in Mount Hope Bay where a part of the export cables ran perpendicular to the currents which, combined with the fine grade resuspended sediments, increased the overall material transport extending the maximum 100 mg/L concentration a little over 0.62 mile (1 kilometer). Concentrations reached levels of 500 mg/L but were short lived and persist for approximately 30 minutes to an hour. Concentrations in the range of 200 mg/L or more were not expected to endure for longer than about 2 hours, while the lowest concentrations, in the 10 mg/L range, may last many hours after resuspension. In regions with larger grain sizes, sediments dropped back to the sea floor more quickly, keeping concentrations low, and within a few meters of the trenching tool. The associated deposition footprint area was also small. Concentrations of 100 mg/L were predicted to be within 160 feet (50 meters) of the route centerline and decreased in less than 15 minutes. The sections of the offshore ECC segment that had higher amounts of fine sediments had higher transport of the model predicted TSS concentrations showing the 100 mg/L concentration extending to 984 feet (300 meters). The 100 mg/L TSS concentration level or greater covered a total of 6,070 acres (25 square kilometers) along the entire length of the Brayton Point ECC (COP Appendix F3; SouthCoast Wind 2024).

The HDD exit pit dredging impacts were smaller compared with the impact resulting from cable installation. The source was assumed to be at a single point and continuous over a 1-hour period, releasing 100 percent of the dredged material into the water column. The TSS concentrations exceeding 100 mg/L traveled a maximum distance of 0.2 mile (0.32 kilometer) and dissipated in a little over an hour at the Brayton Point site but were half that at the Aquidneck Island sites. The area coverage of the 100 mg/L or greater level was contained within an average of 12 acres (5 hectares).

The depositional footprint resulting from the cable installation occurred relatively locally along the majority of the ECC route where the mass settles out quickly. Deposition thicknesses of 0.04 inch (1 millimeter) and greater are mostly limited to a corridor with a maximum width of 100 to 115 feet (30 to 35 meters) around the cable centerline. In the areas where there are finer grain sediments, the 0.04-inch (1-millimeter) thickness contour distance can increase locally to 540 feet (165 meters) from the ECC indicative centerline. The sedimentation footprint for HDD sites was very small with a maximum coverage of the 0.04-inch (1-millimeter) thickness contour of only 1.2 acres (0.5 hectare), extending a maximum distance of 312 feet (95 meters) and 2.5 acres (1 hectare) for the 0.02-inch (0.5-millimeter) thickness contour, extending a maximum distance of 518 feet (158 meters) from the HDD site. Deposition thicknesses are greater if the location of the release is fixed. Cable burial operations are mobile and thus will produce smaller maximum deposit thicknesses. The total coverage of the 0.04-inch (1-millimeter) and 0.02-inch (0.5-millimeter) thickness levels along the entire ECC route was 892 acres (361 hectares) and 1,312 acres (531 hectares), respectively.

These impacts on water quality for finer sediments are anticipated to be localized adjacent to the trench and temporary in nature. Therefore, given the known hydrodynamic conditions within the area of the Project and the expected BMPs associated with jet plowing technologies, no long-term impacts on water quality are anticipated following cable installation activities. BOEM anticipates the Proposed Action alone would have negligible, long-term impacts on water quality via this mechanism. Overall, impacts on water quality from the Proposed Action due to cable emplacement and resulting suspension of sediment and turbidity would be short term and minor.

Port utilization: The current bearing capacity of existing ports was considered suitable for WTGs, requiring no port modifications for supporting offshore wind energy development (DOE 2014). During construction, several ports may be used, including the ports of New Bedford, Fall River, and Salem, Massachusetts; Davisville and Providence, Rhode Island; New London, Connecticut; Sparrows Point, Maryland; Charleston, South Carolina; and Corpus Christi, Texas as well as some international ports. O&M vessel trips would originate primarily from the ports of New Bedford and Fall River, Massachusetts; New London, Connecticut, or Providence, Rhode Island with the potential for occasional repair and supply delivery trips originating from ports in Davisville and Providence, Rhode Island; Salem, Massachusetts; Sparrows Point, Maryland; and Charleston, South Carolina. The impacts on water quality could include accidental fuel spills or sedimentation during port use. The incremental increases in ship traffic at the ports would be small; multiple authorities regulate water quality impacts from these operations (BOEM 2019). Therefore, the impacts of the Proposed Action alone on water quality from port utilization would be negligible.

Presence of structures: Existing stationary facilities that present allision risks are limited in the open waters of the geographic analysis area. Dock facilities and other structures are concentrated along the coastline. The Proposed Action would add up to 147 WTGs, 5 OSPs, and related Project elements, which would increase seabed disturbance and potential water quality impacts. As described in Section 3.4.2.3, *Impacts of Alternative A – No Action on Water Quality*, offshore wind projects have the potential to alter local and regional physical oceanic processes (e.g., currents, temperature stratification) via their influence on currents from WTG foundations and by extracting energy from the wind.

Disturbances from offshore wind structures would be localized but, depending on the hydrologic conditions, have the potential to affect water quality through altering mixing patterns and the formation of sediment plumes. The alteration of mixing patterns can potentially cause lower oxygen levels which can produce harmful algal blooms. There has been no definitive correlation made between the construction of offshore wind facilities and decreases in oxygen levels or increases in harmful algal blooms. There is evidence that the decrease in oceanic oxygen levels and increase in harmful algal blooms is likely a result of ocean warming caused by climate change (Mahaffey et al. 2020; Dai et al. 2023). Harmful algal blooms occur due to diatoms that produce high concentrations of domoic acid. Sterling et al. (2022) suggests that a particularly toxic species of domoic acid producing diatom (*Pseudo-nitzschia australis*) occurring in the Narragansett Bay is not a resident species and likely introduced from offshore in 2016. The same study (Sterling et al. 2022) indicates that the likely introduction of *P. australis* may have been driven by climate change along the Northwest Atlantic Shelf.

The addition of scour protection would further minimize effects on local sediment transport. The impacts from the Proposed Action on water quality due to the presence of structures would be negligible to minor during construction, O&M, and conceptual decommissioning. In addition, as described in Section 3.4.2.3, the exposure of offshore wind structures to the marine environment can result in emissions of metals and organic compounds from corrosion protection systems. However, the current understanding of chemical emissions for offshore wind structures is that emissions appear to be low, suggesting a low environmental impact (Kirchgeorg et al. 2018). Leading edge erosion has been discovered to emit Bisphenol A (BPA) and per- and polyfluoroalkyl substances (PFAS) known as "forever chemicals" into the water, which can then contaminate the marine food chain. There are currently no studies available that identify the amounts of these chemicals that are emitted by turbine blade erosion.

USEPA is currently proposing and implementing actions related to PFAS better understand and reduce potential risks associated with these chemicals that will help to guide future regulations.

Discharges/intakes: During construction of the Proposed Action, vessel traffic would increase in and around the Wind Farm Area, leading to potential discharges of uncontaminated water and treated liquid wastes. Table 3-25 of the COP lists types of waste potentially produced by the Proposed Action (COP Volume 1, Section 3.3.16, Table 3-25; SouthCoast Wind 2024). SouthCoast Wind would only be allowed to discharge uncontaminated water (e.g., uncontaminated ballast water and uncontaminated water used for vessel air conditioning) or treated liquid wastes overboard (e.g., treated deck drainage and sumps). Other waste such as sewage and solid waste or chemicals, solvents, oils, and greases from equipment, vessels, or facilities would be stored and properly disposed of on land or incinerated offshore.

SouthCoast Wind expects substantially less vessel use during routine O&M than during construction. Vessel use would consist of scheduled inspection and maintenance activities, with corrective maintenance as needed. In a year, the Proposed Action would generate a maximum of 100 crew vessel trips, 1 jack-up vessel trip, 24 supply vessel trips, and 250 helicopter trips during O&M (COP Volume 1, Section 3.3.14.2, Table 3-23; SouthCoast Wind 2024). The proposed Project would require all vessels to comply with regulatory requirements related to the prevention and control of discharges, accidental spills, and nonindigenous species. All vessels would need to comply with waste and water management regulations described in Section 3.4.2.3, including USCG ballast water management requirements and USCG bilge water regulation. The bilge water from the proposed Project would either be retained onboard vessels in a holding tank and discharged to an onshore reception facility or treated onboard, after which the treated water could be discharged overboard. In addition, bilge water would not be allowed to be discharged into the sea unless the oil content of the bilge water without dilution is less than 15 parts per million (33 CFR Part 151.10). For vessels operating within 3 nautical miles (5.6 kilometers) from shore, bilge water regulations under USEPA's NPDES program apply to any of the proposed Project's vessels that are covered by a Vessel General Permit (those that are 79 feet [24 meters] or greater in length). Bilge discharges within 3 nautical miles (5.6 kilometers) from shore are subject to the rules in Section 2.2.2 of the Vessel General Permit and must occur in compliance with 40 CFR Parts 110, 116, and 117, and 33 CFR 151.10. With implementation of these AMMs and the described regulatory requirements, the temporary impact of routine vessel discharge is expected to be minor.

The WTGs and OSPs are generally self-contained and do not generate chemical discharges under normal operating conditions. In the event of a spill related to an allision or other unexpected or low-probability event, impacts on water quality from chemical discharges from the WTGs or OSPs during operation would be temporary. During decommissioning, SouthCoast Wind would drain all fluid chemicals from the WTGs and OSPs via vessel and dismantle and remove them. There would be no discharge of fluid chemicals in the ocean during the decommissioning of offshore wind structures. BOEM anticipates decommissioning to have temporary impacts on water quality, with a return to baseline conditions.

SouthCoast Wind has proposed the use of one or more HVDC converter platforms, which would require seawater to be pumped in to cool the electrical equipment and then discharged back into the ocean.

SouthCoast Wind developed an NPDES permit application for one offshore HVDC converter station in the Lease Area for Project 1 (see Appendix B, Figure B-2) (TetraTech and Normandeau Associates, Inc. 2023). Refer to Appendix B for the parameters of the HVDC converter OSP cooling water intake system (CWIS). If SouthCoast Wind uses HVDC technology for Project 2, there would likely be one additional HVDC converter OSP (for a total of two HVDC OSPs). The parameters and modeling results from the NPDES permit application for Project 1 are representative of a second HVDC converter OSP for Project 2 in the Lease Area. The only anticipated difference would be the location of the second HVDC converter OSP, which would be at a deeper position in the southern portion of the Lease Area. A separate NPDES permit application would need to be submitted to and approved by USEPA for any additional HVDC converter OSPs.

Based on the NPDES permit application, one HVDC converter station is expected to withdraw cooling water from the ocean at a rate of up to 9.9 million gallons per day and maintain an intake velocity of less than or equal to 0.5 feet per second to minimize impingement impacts.[2] SouthCoast Wind modeled thermal plumes from HVDC cooling water discharge to evaluate the spatial extent of the rise in temperatures of the receiving water in the vicinity of the discharge location based on the highest temperature differences between ambient (intake) and effluent (discharge) conditions in the fall (Scenario 1), winter (Scenario 2), spring (Scenario 3), and summer (Scenario 4) using a thermal mixing zone analysis in CORMIX v12.0GTD Advanced Tools (TetraTech and Normandeau Associates, Inc. 2023).

The following parameters were used to define the typical operating conditions based on the design intake flow (DIF) of 9.9 MGD.

- DIF = 1,560 m^3/h (9.9 MGD) during two-pump operations.
- Depth of discharge = 42.7 feet (13 meters) below the surface, 108.9 feet (33.2 meters) above the seafloor.
- Maximum discharge temperature = 86°F (30°C).

The plume dynamics were evaluated during four separate seasons to determine potential zones of initial dilution during those periods. According to the USEPA's Criterion Continuous Concentration for temperature-based water quality, the maximum acceptable increase in weekly average temperature resulting from artificial heat sources is 1.8°F (1°C) during all seasons of the year (USEPA 1986). Furthermore, the radius requirement for the 1.8°F (1°C) temperature increase caused by a discharge within the predicted zone of initial dilution should be less than 330 feet (101 meters) as described in the Ocean Discharge Criteria at CFR 125.121(c) (Tetra Tech and Normandeau Associates, Inc. 2023).

From four modeled maximum temperature delta scenarios (Table 3.4.2-9), the distance from the discharge point where the temperature delta reached 1°C (1.8°F) was 41.9 feet (12.8 meters) in the fall, 84.9 feet (25.9 meters) in the winter, 67.5 feet (20.6 meters) in the spring, and 46.6 feet (14.2 meters) in the summer. The effluent plume area was highest in the winter at 792.1 square feet (73.6 square

[2] USEPA considers intake velocities of 0.5 feet per second or less a suitable compliance option to minimize impingement impacts.

meters) and lowest in the fall at 407.0 square feet (37.8 square meters). These CORMIX results indicate that impacts on the ocean temperature are localized and minimal when the maximum temperature increases occur and that the water quality standard allowed for by the Ocean Discharge Criteria is expected to be met well within the 330-foot (100-meter) radius mixing zone for initial dilution of discharges (Tetra Tech and Normandeau Associates, Inc. 2023). Four scenarios were modeled to provide the expected maximum extent of the plume (maximum tidal velocities) and maximum concentrations of the plume (minimum tidal velocities). See Table 3.4.2-9 for results of plume modeling for each scenario.

Table 3.4.2-9. CORMIX results for maximum temperature delta scenarios for a SouthCoast Wind HVDC OSP modeled in the Atlantic Ocean

Parameter	Scenario 1: Fall	Scenario 2: Winter	Scenario 3: Spring	Scenario 4: Summer
Maximum discharge temperature, °F (°C)	86 (30)			
Minimum ambient Atlantic Ocean temperature, lowest seasonal observed, °F (°C)	54.1 (12.3)	39.6 (4.2)	38.6 (3.7)	51.3 (10.7)
Maximum temperature delta, °F (°C)	31.9 (17.7)	46.4 (25.8)	47.4 (26.3)	34.7 (19.3)
Resulting Atlantic Ocean temperature at the edge of the plume, °F (°C)	55.9 (13.3)	41.4 (5.2)	40.4 (4.7)	53.1 (11.7)
Dilution ratio at the edge of the plume	17.8	25.8	26.3	19.7
Thermal plume length ft (m)	41.9 (12.8)	84.9 (25.9)	67.5 (20.6)	46.6 (14.2)
Thermal plume width, ft (m)	11.8 (3.6)	11.1 (3.4)	12.8 (3.9)	28.7 (8.7)
Plume area, ft^2 (m^2)	407.0 (37.8)	792.1 (73.6)	721.2 (67.0)	657.1 (61.0)

Source: Tetra Tech and Normandeau Associates, Inc. 2023; Appendix A
[a] Distance from the outfall, where the temperature delta reaches 1°C (1.8°F).
°C = degrees Celsius ; °F = degrees Fahrenheit; ft = feet; ft^2 = square feet; m = meters; m^2 = square meters

Considering the slight increases in water temperatures and small size of the thermal plume area, in the context of the overall size of the Lease Area (127,388 acres [51,552 hectares]), minimal impacts on water temperature are anticipated. Based on results of the thermal plume modeling, impacts from the discharge are expected to be localized and minimal, especially where the plume is controlled by discharge characteristics. Similar results would be anticipated if SouthCoast Wind selects additional HVDC converter OSP(s) for the southern portion of the Lease Area associated with Project 2. Because the impacts from each OSP would be localized and minimal, the combined impacts from thermal plume discharges from multiple HVDC converter OSPs under the Proposed Action are anticipated to be minor. Bleach (sodium hypochlorite) would be used to inhibit marine growth in the HVDC cooling equipment (COP Volume 1, Section 3.4.5; SouthCoast Wind 2024). A hypochlorite generator would produce the sodium hypochlorite by seawater electrolysis. These generators are designed to achieve a hypochlorite solution flow rate of sufficient concentration, corresponding with a 1 to 4 parts per million equivalent free chlorine concentration in the seawater intake lines. This concentration is small and is equivalent to 0.0002 percent per unit volume. The residual free chlorine at the outlet would be negligible and would be oxidized in the water (TetraTech and Normandeau Associates, Inc. 2023). No chemicals are involved in the cleaning cycles of the HVDC converter. The impact on water quality from the discharge of warm seawater with small concentrations of bleach would be negligible if discharge concentrations meet the water quality-based limits of SouthCoast Wind's NPDES permit.

Impacts would be localized to the area immediately surrounding the outlet pipe.

Overall, the impacts on water quality from the Proposed Action would be short term and minor during construction and, to a lesser degree, during decommissioning. During operations, the number of vessels in use would decrease even more, resulting in fewer impacts.

Land disturbance: Construction and installation of onshore components (e.g., substations, cable installation) would disturb ground and lead to unvegetated or otherwise unstable soils until permanent stabilization is achieved. Onshore construction would disturb the ground with typical depths of up to 8 feet (2.4 meters) (e.g., trenching for onshore cable installation) but could be deeper depending on survey results and potential utility crossings, which could have potential to interact with groundwater if groundwater were shallow enough to interact with the disturbance. Any contaminants spilled during construction would be localized, contained, and cleaned up per permitting requirements and SouthCoast Wind's OSRP and, therefore, would not be anticipated to reach groundwater or have any effect on groundwater quality. The sites for the up to two converter stations at Brayton Point and one substation at Falmouth would require up to 20 acres (4 hectares) and 26 acres (10.5 hectares), respectively, to accommodate the area for the converter and substation equipment and buildings, energy storage, stormwater management, and landscaping. Total temporary and permanent disturbance associated with onshore components if Brayton Point is the POI for Project 1 and Project 2 is approximately 26 acres (10.5 hectares) (COP Volume 1, Table 3-39; SouthCoast Wind 2024). Total temporary and permanent disturbance associated with onshore components if Brayton Point is the POI for Project 1 and Falmouth is the POI for Project 2 is approximately 65 acres (26.5 hectares) (COP Volume 1, Table 3-39; SouthCoast Wind 2024). Precipitation events could potentially erode the soils and discharge sediment-laden runoff into nearby surface waters, leading to increased turbidity. SouthCoast Wind would implement erosion and sedimentation controls during the construction period. Construction would lead to an increased potential for water quality impacts resulting from accidental fuel spills or sedimentation in waterbodies. The incremental increases in land disturbance from the Proposed Action would be small, and AMMs, such as the use of an OSRP and SWPPP, would be implemented. As such, impacts from the Proposed Action on water quality from land disturbance would be negligible to minor.

Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned non-offshore wind and offshore wind activities. Ongoing and planned non-offshore wind activities related to onshore development, terrestrial runoff and discharges, marine transportation-related discharges, dredging and port improvement projects, commercial fishing, military use, submarine cables and pipelines, atmospheric deposition, and climate change would contribute to impacts on water quality through the primary IPFs of accidental releases, anchoring, cable emplacement and maintenance, port utilization, presence of structures, discharges, and land disturbance. The construction, O&M, and decommissioning of both onshore and offshore infrastructure for offshore wind activities in the geographic analysis area would also contribute to water quality impacts associated with the same IPFs.

The Proposed Action would contribute to the combined accidental release impacts on water quality from ongoing and planned activities including offshore wind. Given the low probability of these spills occurring, BOEM does not expect ongoing and planned activities, including the Proposed Action, to appreciably contribute to impacts on water quality resulting from oil and chemical spills. The Proposed Action would contribute to the combined anchoring impacts on water quality from ongoing and planned activities including offshore wind. The contribution from the Proposed Action to increased sediment concentration and turbidity would be additive with the impact(s) of any and all other cable installation activities, including offshore wind activities, that occur within the water quality geographic analysis area and that would have overlapping timeframes during which sediment is suspended. Multiple offshore wind projects may overlap in cable installation activity in the geographic analysis area and contribute to these temporary impacts (refer to Appendix D for construction schedules of specific projects). The Proposed Action would contribute to the combined port utilization impact on water quality from ongoing and planned activities, which is anticipated to be minor due to the need for minimal port modifications or expansions and the small increase in ship traffic. The cumulative impacts of combined accidental releases, anchoring, and port utilization would likely be temporary (during construction), localized, and minor.

The presence of structures from the Proposed Action and other offshore wind projects would increase seabed disturbance and potential water quality impacts. In the water quality geographic analysis area, offshore wind activities including the Proposed Action would result in 2,994 acres (1,212 hectares) of impact from installation of foundations and scour protection, 13,720 acres (5,552 hectares) of impact from installation of offshore and interarray cables, and 1,401 acres (567 hectares) of impact from hard protection for offshore cables and interarray cables. Of these seabed disturbances, the Proposed Action would contribute 4,988 acres, or 28 percent. The impacts would be mostly localized and are not anticipated to degrade regional water quality. Cumulative impacts on water quality would likely be minor and constant over the lifespans of the reasonably foreseeable activities.

Impacts on water quality from the Proposed Action due to discharges would be additive with the impact(s) of any and all discharges, including those of other offshore wind activities that occur within the water quality geographic analysis area during the same timeframe. Vessel traffic (e.g., fisheries use, recreational use, shipping activities, military uses) in the region would overlap with vessel routes and port cities expected to be used for the Proposed Action, and vessel traffic would increase under the Proposed Action. Discharge events would mostly be staggered over time and localized, and all vessels would be required to comply with regulatory requirements related to prevention and control of discharges, accidental spills, and nonindigenous species administered by USEPA, USACE, USCG, and BSEE. Therefore, the cumulative impacts on water quality would likely be short term, localized, and minor primarily during construction and to a lesser extent during decommissioning and operations.

Cumulative impacts of land disturbance impacts on water quality would likely be localized, short term, and minor due to the low likelihood that construction of onshore components would overlap in time and space, and the minimal amount of expected discharge of sediment-laden runoff into nearby waterbodies.

Overall, the cumulative impact on water quality would likely be minor but could increase to moderate in the unlikely event of a large-volume, catastrophic release. In the context of reasonably foreseeable environmental trends, the Proposed Action could contribute a detectable increment to the cumulative impacts on water quality.

Conclusions

Impacts of the Proposed Action: BOEM anticipates the impacts on water quality resulting from the Proposed Action would be **minor adverse**. Impacts from routine activities including sediment resuspension during construction and decommissioning, both from regular cable laying and from prelaying, dredging, vessel discharges, sediment contamination, discharges from the WTGs or OSP during operation, sediment plumes due to scour, and erosion and sedimentation from onshore construction, would be negligible to minor. Impacts from non-routine activities, such as accidental releases, would be minor from small spills. While a larger spill could have moderate impacts on water quality, the likelihood of a spill this size is very unlikely. The impacts associated with the Proposed Action are likely to be temporary or small in proportion to the geographic analysis area, and the resource would recover completely after decommissioning.

Cumulative Impacts of the Proposed Action: BOEM anticipates that the cumulative impacts on water quality in the geographic analysis area would be **minor adverse**. BOEM has considered the possibility of a moderate impact resulting from accidental releases; this level of impact could occur if there was a large-volume, catastrophic release. While it is an impact that should be considered, it is unlikely to occur. In context of reasonably foreseeable environmental trends, the incremental impacts contributed by the Proposed Action to the cumulative impacts on water quality would be detectable should a large-volume, catastrophic release occur. The Proposed Action would contribute to the cumulative impact rating primarily through the increased turbidity and sedimentation due to anchoring and cable emplacement during construction, and alteration of water currents and increased sedimentation during operation due to the presence of structures.

3.4.2.6 Impacts of Alternatives C, D (Preferred Alternative), E, and F on Water Quality

Impacts of Alternatives C, D, E, and F: The impacts resulting from the installation of offshore wind infrastructure under Alternatives C, D, E, and F would be either the same or less than those described under the Proposed Action due to the same (Alternatives C and E) or reduced (Alternatives D and F) number of structures and offshore export cables in the Wind Farm Area. While Alternative F would still have the same number of overall offshore structures in the Lease Area, the reduced number of Falmouth export cables using HVDC technology would require the construction of an HDVC converter station OSP that may otherwise not be necessary under the Proposed Action. While the reduced number of structures and offshore export cables may slightly reduce localized water quality impacts during construction and operations, the difference in impacts compared to the Proposed Action would not be materially different. BOEM expects that the modifications to the Brayton Point export cable route under Alternative C-1 and Alternative C-2 would slightly reduce the potential for offshore water quality impacts because cable emplacement would be avoided in the Sakonnet River. Onshore, however, Alternative C-1 and Alternative C-2 would slightly increase the potential water quality impacts because of the longer onshore cable routes. Because the cables would be installed largely within existing road ROWs and mitigation measures, such as the use of an SPCC plan and SWPPP, would be implemented, Alternative C-1 and Alternative C-2 are not expected to significantly change the potential impacts on water quality. Similarly, reducing the number of Falmouth offshore export cables from five to three under Alternative F as compared to the Proposed Action is not expected to substantively change the potential impacts on water quality because cable emplacement would still result in short-term and localized sediment suspension. The addition of another HVDC converter station OSP under Alternative F for the Falmouth export cables for Project 2 (in addition to the HVDC OSP already proposed for Project 1 at Brayton Point) would increase impacts on water temperature during operations. As previously stated for the Proposed Action, the proposed HVDC converter OSP would use an open-loop cooling system that would cause a slight, localized increase in water temperature in the vicinity of the effluent diffuser. However, based on thermal plume modeling conducted for the Project, impacts on water quality from the effluent created by the HVDC structure are expected to be minimal, and a second OSP would not substantially change the overall impact rating given the small area that would be affected. In addition, the discharge of bleach from a second HVDC converter would have little effect on water quality around the discharge location due to the very low concentrations of bleach.

Under Alternative E-1, piled-jacket foundations are expected to have fewer sediment effects than monopiles due to lower scour potential and smaller wake effects. The GBS foundations proposed under Alternative E-3 and suction-bucket foundations proposed under Alternative E-2 may have larger sediment effects than monopiles and piled jackets (Alternative E-1) because of their larger scour potential (BOEM 2021). Overall, the GBS foundations proposed under Alternative E-3 would require larger disturbance footprints than the piled foundations and suction-bucket foundations under Alternative E-1 and Alternative E-2, potentially resulting in greater water quality impacts than the Proposed Action (which does not include GBS foundations).

Cumulative Impacts of Alternatives C, D, E, and F: In context of reasonably foreseeable environmental trends, cumulative impacts of Alternatives C, D, E, and F on water quality would be similar to those of the Proposed Action.

Conclusions

Impacts of Alternatives C, D, E, and F: The expected **minor adverse** impacts associated with the Proposed Action would not change substantially under Alternatives C, D, E, and F. The same construction and installation, O&M, and conceptual decommissioning activities would still occur, albeit at differing scales in some cases. Alternative C-1 and Alternative C-2 would result in similar, but not materially different, minor impacts on water quality in relation to sediment disturbance and turbidity and onshore ground disturbance. Alternative D may result in slightly less, but not materially different, minor impacts on water quality due to a reduced number of WTGs that would be constructed and maintained. Due to the size of the foundations, Alternative E-3 (GBS) and Alternative E-2 (suction-bucket) would result in slightly greater sediment effects than Alternative E-1 (piled) and the Proposed Action, although the overall magnitude of impacts would remain **minor adverse**. Alternative F would result in the same minor impacts on water quality from the modification to the Falmouth offshore export cables. The addition of an HVDC converter station OSP using an open-loop cooling system would cause a slight increase in impacts on water temperature but would not be substantially different from the Proposed Action.

Cumulative Impacts of Alternatives C, D, E, and F: In the context of reasonably foreseeable environmental trends, the cumulative impacts associated with Alternatives C, D, E, and F would be the same as the Proposed Action—**minor adverse**, but with a possibility of a moderate impact resulting from accidental releases; this level of impact could occur if there was a large-volume, catastrophic release. While it is an impact that should be considered, it is unlikely to occur.

3.4.2.7 Comparison of Alternatives

The minor impacts associated with the Proposed Action would be the same for Alternatives C, D, E, and F. Alternative C-1 and Alternative C-2 would result in similar, but not materially different, minor impacts on water quality in relation to sediment disturbance and turbidity and onshore ground disturbance. Alternative D may result in slightly less, but not materially different, minor impacts on water quality due to a reduced number of WTGs that would be constructed and maintained. Due to the size of the foundations, Alternative E-3 (GBS) and Alternative E-2 (suction-bucket) would result in slightly greater sediment effects than Alternative E-1 (piled) and the Proposed Action, although the overall magnitude of impacts would remain minor. Alternative F would result in the same minor impacts on water quality from the modification to the Falmouth offshore export cables. The addition of an HVDC converter station OSP using an open-loop cooling system would cause an increase in impacts on water temperature but would not change the impact magnitude.

3.4.2.8 Proposed Mitigation Measures

No measures to mitigate impacts on water quality have been proposed for analysis.

3.5 Biological Resources

3.5.1 Bats

This section discusses the potential impacts on bat populations from the proposed Project, alternatives, and ongoing and planned activities in the bat geographic analysis area. The bat geographic analysis area, as shown on Figure 3.5.1-1, includes the United States coastline from Maine to Florida, and extends 100 miles (161 kilometers) offshore and 5 miles (8 kilometers) inland to capture the movement range for species in this group. The geographic analysis area for bats was established to capture most of the movement range for migratory species. The offshore limit was established to capture the migratory movement of most species in this group, while the onshore limits cover onshore habitats used by species that may be affected by onshore and offshore components of the proposed Project.

3.5.1.1 Description of the Affected Environment

The number of bat species in the geographic analysis area varies by state, ranging from eight species (Rhode Island, New Hampshire, and Maine) to 17 (Virginia and North Carolina) (RIDEM n.d.; Maine Department of Inland Fisheries and Wildlife 2021; New Hampshire Fish and Game n.d.; Virginia Department of Wildlife Resources 2021; North Carolina Wildlife Resources Commission 2017).

There are nine species of bats known to occur in Massachusetts and Rhode Island, eight of which may be present in the immediate Project area and six that are year-round residents. These species can be broken down into cave-hibernating bats and migratory tree bats based on their wintering strategy. Bats are terrestrial species that spend almost their entire lives on or over land. On occasion, tree bats can occur offshore during spring and fall migration and under very specific conditions like low wind and high temperatures. Recent studies, combined with historical anecdotal accounts, indicate that migratory tree bats sporadically travel offshore during spring and fall migration, with 80 percent of acoustic detections occurring in August and September (Dowling et al. 2017; Hatch et al. 2013; Pelletier et al. 2013; Stantec 2016a). However, unlike tree bats, the likelihood of detecting a *Myotis* species or other cave bat is substantially less in offshore areas (Pelletier et al. 2013). Table 3.5.1-1 shows the bats that are present in Massachusetts and Rhode Island and their associated conservation status.

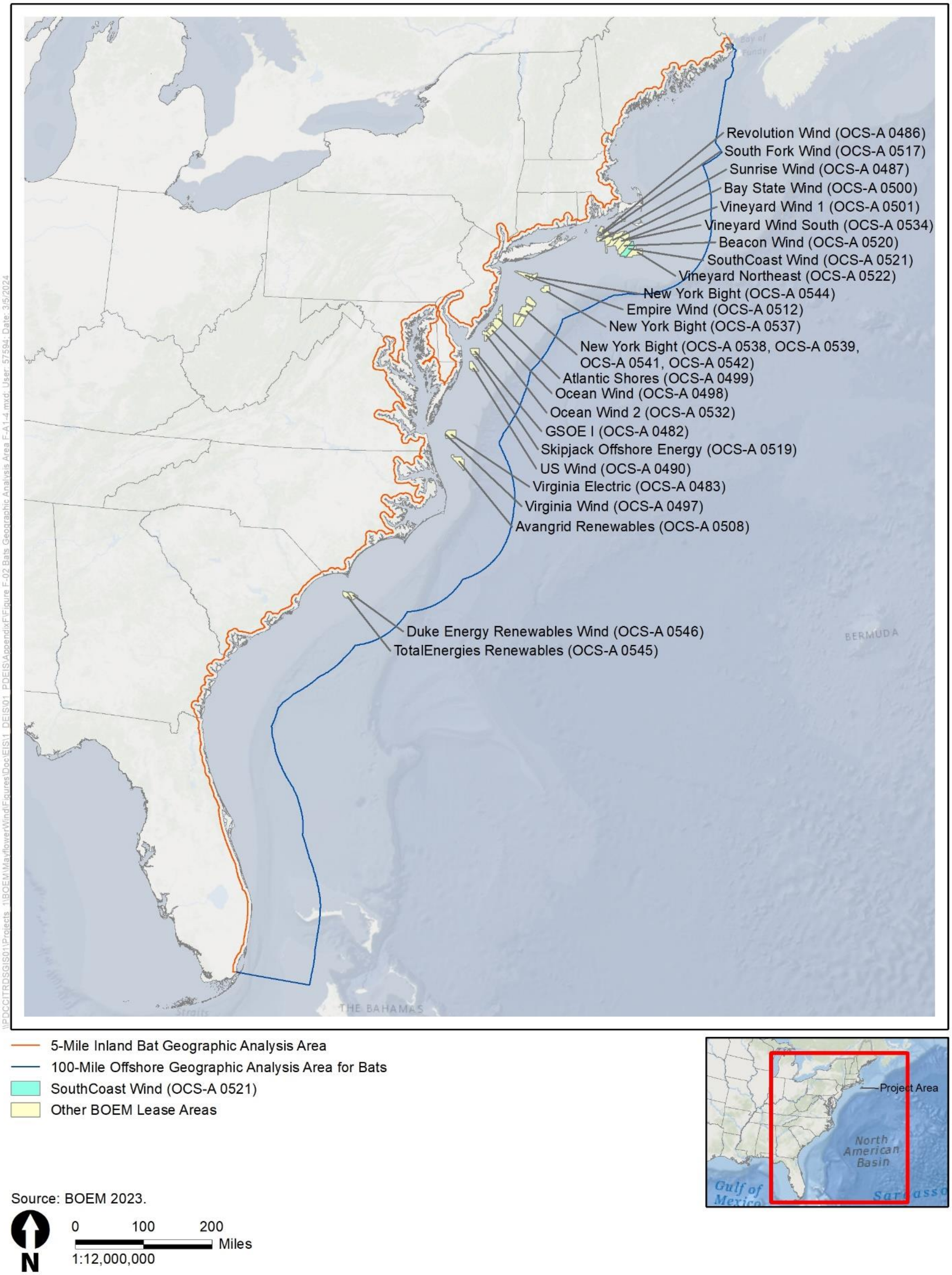


Figure 3.5.1-1. Bats geographic analysis area

Table 3.5.1-1. Bats present in Massachusetts and Rhode Island and their conservation status

Common Name	Scientific Name	Massachusetts State (MESA)	Rhode Island State (RI Natural History Survey)	Federal Status
Cave-Hibernating Bats				
Eastern small-footed bat	*Myotis leibii*	Endangered	SGCN	-
Little brown bat	*Myotis lucifugus*	Endangered	SGCN	Under Review [d]
Northern long-eared bat [a]	*Myotis septentrionalis*	Endangered	SGCN	Endangered
Indiana bat [b]	*Myotis sodalist*	Endangered	-	Endangered
Tricolored bat [c]	*Perimyotis subflavus*	Endangered	SGCN	Under Review [e]
Big brown bat	*Eptesicus fuscus*	-	SGCN	-
Migratory Tree Bats				
Eastern red bat	*Lasiurus borealis*	-	SGCN	-
Hoary bat	*Lasiurus cinereus*	-	SGCN	-
Silver-haired bat	*Lasionycteris noctivagans*	-	SGCN	-

Source: SouthCoast Wind 2024; USFWS 2021; Massachusetts Endangered Species Act 2017; RIDEM 2015.
[a] On November 29, 2022, USFWS announced its intention to reclassify the northern long-eared bat as endangered. The new rule pertaining to the further conservation of the species took effect on March 31, 2023.
[b] Range does not indicate species presence in the Project area.
[c] USFWS proposed to list the species as endangered as of September 14, 2022, and a final determination is anticipated in Fiscal Year 2024.
[d] Currently under a USFWS discretionary status review. Results of the review may be to propose listing, make a species a candidate for listing, provide notice of a not warranted candidate assessment, or other action as appropriate.
[e] Currently under a USFWS discretionary status review. Results of the review may be to list the species as threatened instead of endangered, or that the species does not warrant listing as either an endangered species or a threatened species.
SGCN = Species of Greatest Conservation Need

Bat species can be classified as migratory tree-roosting bats (tree bats) or cave-hibernating bats based on their wintering strategy. Tree-roosting bats with continental migratory patterns that may occur in the Project area include the silver-haired bat (*Lasionycteris noctivagans*), eastern red bat (*Lasiurus borealis*), and hoary bat (*Lasiurus cinereus*). Cave-hibernating bats that may occur in the Project area include the big brown bat (*Eptesicus fuscus*), tricolored bat (*Perimyotis subflavus*), and three *Myotis* species: the eastern small-footed bat (*Myotis leibii*), little brown bat (*Myotics lucifugus*), and northern long-eared bat (*Myotis septentrionalis*). The tricolored bat and the three *Myotis* species are listed as endangered under the Massachusetts ESA. In addition, the northern long-eared bat was listed by USFWS as federally threatened in 2015 and recently reclassified as endangered (effective January 30, 2023) (USFWS 2022), the tricolored bat has been petitioned for federal listing, and the little brown bat federal listing is under review. All eight bat species in the Project area are listed as Species of Great Conservation Need (SGCN) in the 2015 State Wildlife Action Plan for Rhode Island (SouthCoast Wind 2024).

The presence of bats has been documented in the offshore marine environment in the United States (Cryan and Brown 2007; Stantec 2016a; Dowling et al. 2017; Hatch et al. 2013; Pelletier et al. 2013). Bats have been documented temporarily roosting on structures (i.e., lighthouses) on nearshore islands

(Dowling et al. 2017), and there is evidence of eastern red bats migrating offshore in the Atlantic. In a mid-Atlantic study conducted during the spring and fall of 2009 and 2010, the maximum distance that bats were detected from shore was 13.6 miles (21.9 kilometers) with an average distance of 5.2 miles (8.4 kilometers), and the eastern red bat represented 78 percent of all bat detections offshore (Sjollema et al. 2014). In Maine, bats were detected on islands up to 25.8 miles (41.6 kilometers) from the mainland. In addition, eastern red bats were detected in the mid-Atlantic up to 27.3 miles (44 kilometers) offshore by high-definition video aerial surveys (Hatch et al. 2013). At this time, there is some uncertainty regarding the level of bat use of the OCS. However, available data indicate that bat activity levels are generally greater onshore compared to offshore (Hein et al. 2021). For example, a bat migration study in the North Sea off Belgium found that the number of bat detections was up to 24 times higher at onshore locations compared to the offshore locations within a wind farm (Brabant et al. 2021).

Cave-hibernating bats overwinter regionally in caves, mines, and other structures (e.g., buildings) and feed primarily on insects in terrestrial and fresh-water habitats. These species generally display lower activity in the offshore environment than the migratory tree bats (Sjollema et al. 2014), with movements mainly during the fall months. In the mid-Atlantic, the maximum distance *Myotis* bats were detected offshore was 7.2 miles (11.5 kilometers) (Sjollema et al. 2014). A recent nano-tracking study on Martha's Vineyard recorded little brown bat movements off the island in late August and early September, with one individual flying from Martha's Vineyard to Cape Cod (Dowling et al. 2017). These findings are supported by an acoustic study conducted on islands and buoys off the Gulf of Maine that demonstrated the highest percentage of activity occurs during the months of July through October (Peterson et al. 2014). Offshore acoustic bat surveys were conducted in the Lease Area (OCS-A 0499) in 2020 and 2021 (Table 3.5.1-2). During these surveys, 26 big brown bats, 5 tricolored bats, and 3 bats belonging to *Myotis* spp. were detected. Due to insufficient information, which otherwise would allow for a species identification, 478 recordings were categorized into the big brown/silver bat group. Cave-hibernating bats were likely among those categorized in this group; however, based on the number of positively identified silver-haired bats (80) compared to the number of positively identified big brown bats (26), big brown bats likely only proportionally account for one-third (an estimated 157 recordings) of the recordings in this group. Given the use of coastlines as migratory routes by cave-hibernating bats is likely limited to their fall migration period, that acoustic studies indicate lower use of the offshore environment, and that cave-hibernating bats do not habitually feed on insects over the ocean, exposure to the proposed Project is likely low for cave-hibernating bats.

Tree bats are more likely to be detected in the offshore environment than cave-hibernating bats. Tree bats migrate long distances to overwinter and have been documented using coastlines and islands offshore during migration (Normandeau Associates 2014; Hatch et al. 2013; Johnson et al. 2011). Eastern red bats have been detected migrating from Martha's Vineyard late in the fall, with one bat tracked as far south as Maryland (Dowling et al. 2017). During a long-term study of bat movements conducted from 2012 to 2014 in the coastal, nearshore, and offshore environments of the Northeast, mid-Atlantic, and Great Lakes (Stantec 2016a; Pelletier et al. 2014), bat calls were detected from 3–80 miles (5–130 kilometers) offshore with detections approximately 9–30 miles (14–49 kilometers) southeast of Montauk and Block Island, west of the Offshore Project area. Eastern red bats and other migrants represented the most frequently observed species with peak activity during the spring and fall migrations. Use of the Offshore Project area is expected to be primarily limited to migration periods.

Onshore coastal areas throughout the geographic analysis area provide habitats that support a diversity of bat species. All bat species present in Massachusetts and Rhode Island (migratory and non-migratory) are nocturnal insectivores that use a variety of forested and open habitats (e.g., waterways, lakes, other waterbodies, agricultural fields) during the summer for foraging and forested habitats for roosting. Roost selection is species-dependent, and while some of these species roost solely in the foliage of trees, others select dead and dying trees where they roost in peeling bark or inside crevices. The Falmouth onshore Project area is within the Atlantic coastal pine barren region and includes natural vegetation consisting of stunted oaks (Quercus spp.; primarily scrub oak [*Quercus ilicifolia*]) and pines (*Pinus* sp.; primarily pitch pine [*Pinus rigida*]) (Swain 2020). The Brayton Point onshore Project area is located within the Northeastern Coastal Zone region and natural communities are limited as the Project is routed within/underneath developed areas, maintained recreational areas, and road services. Aquidneck Island is within the Narragansett/Bristol Lowland region and vegetation varies with oak-pine forests and oak-hickory due to coastal influences, with cranberry bogs and wetlands abundant within the mixed forest (SouthCoast Wind 2024). See COP Appendix I2, *Bat Risk Assessment*, Tables 4-1 and 4-2 for a complete list of natural communities within the Falmouth onshore Project area and Brayton Point onshore Project area, respectively.[1]

There are two buildable substation site options under consideration for the Falmouth onshore Project area, which would require up to 26.0 acres (10.5 hectares) of land. Both substation site options would be located in previously disturbed areas, which are not likely to provide suitable habitat for summer foraging and/or roosting. The Aquidneck Island cable landfall locations are in Portsmouth, Rhode Island and all onshore underground export cable system route options and landfall locations consist of developed land, developed recreation, impervious surfaces (roads), and wetlands. The Brayton Point cable landfall locations are in Somerset, Massachusetts and all landfall options are devoid of natural communities as the area consists of roads and former industrial uses. Up to two converter stations would be constructed at Brayton Point, and each converter station would occupy up to 7.5 acres (3.0 hectares) of primarily disturbed and developed land. Although there are no bat data available specific to the onshore Project area, several mist-netting, acoustic and telemetry surveys at Camp Edwards Joint Base Cape Cod located 8.1 miles (13.1 kilometers) from the Falmouth POI and proposed onshore substation site confirmed the presence of the northern long-eared bat, eastern small-footed bat, little brown bat, and tricolored bat; no roosts were identified within 0.25 mile (0.4 kilometer) of the onshore Project area (COP Volume 2, Section 6.2.1.2, SouthCoast Wind 2024). However, the RIDEM did not identify any presence of northern long-eared bat, eastern small-footed bat, little brown bat, and tricolored bat in the Rhode Island portions of the Brayton Point export cable corridor (Jordan 2021).

---

[1] As described in Chapter 2, Section 2.1.2, *Alternative B – Proposed Action,* Brayton Point is the preferred POI for both Project 1 and Project 2, and Falmouth is the variant POI for Project 2, which would be used if SouthCoast Wind is prevented from using Brayton Point for Project 2.

Caves and mines provide key habitat for cave-hibernating bats. These locations serve as winter hibernacula, fall swarm locations (areas where mating takes place in the fall months), and summer roosting locations for some individuals. For a bat hibernaculum to be occupied within a cave or mine, suitable conditions for temperature, humidity and airflow and minimal disturbance must be met (McAney 1999). The locations for the onshore substation and/or converter stations are not expected to contain caves or mines suitable for winter hibernacula for any cave-hibernating bat species.

The northern long-eared bat is the only bat species listed under the ESA that may occur in the Project area (USFWS 2021). Several mist-netting and acoustic and telemetry surveys at Camp Edwards Joint Base Cape Cod confirmed the presence of northern long-eared bats on Cape Cod and portions of the onshore Project components in Falmouth overlap Massachusetts Priority Habitat 213. However, the Brayton Point onshore Project area is sited within an existing industrial area and the isolated and fragmented nature of the nearby forest lowers the likelihood of northern long-eared bat presence. The nearest maternity colonies are located 34.8 miles (56.0 kilometers) east near Sandwich, Massachusetts, and the nearest hibernaculum is located 40.4 miles (65.0 kilometers) north in Wellesley, Massachusetts (SouthCoast Wind 2024). It is, therefore, not expected that northern long-eared bats would be exposed to the offshore Wind Farm Area. A recent tracking study on Martha's Vineyard (July–October 2016) did not record any offshore movements (Dowling et al. 2017). If northern long-eared bat were to migrate over water, movements would likely be near the mainland. The related little brown bat has been documented to migrate from Martha's Vineyard to Cape Cod, and northern long-eared bat may likewise migrate to mainland hibernacula from these islands in August and September (SouthCoast Wind 2024). Given that there is little evidence of use of the offshore environment by northern long-eared bat, exposure to the proposed Wind Farm Area, if it occurs, is anticipated to be minimal. BOEM prepared a Biological Assessment (BA) for the Project, which provides a detailed discussion of ESA-listed species and potential impacts on these species as a result of the Project (BOEM 2023). Results of ESA consultation with USFWS are included in Section 3.5.1.5, *Impacts of Alternative B – Proposed Action on Bats.*

Cave bat species, including the northern long-eared bat, are experiencing drastic declines due to White Nose Syndrome (WNS) caused by the fungus *Pseudogymnoascus destructans* (MassWildlife 2022). WNS was confirmed as present in Massachusetts in 2008, and Rhode Island in 2016 (Whitenosesyndrome.org 2022; USFWS 2018). Declines in populations of the northern long-eared bat are ongoing as the disease continues to spread throughout the species range (USFWS 2015). Other cave-hibernating species with confirmed presence of WNS include the big brown bat, eastern small-footed bat, little brown bat, and the tricolored bat (USFWS 2018). Proposed Project-related impacts have the potential to affect cave bat populations already affected by WNS. The unprecedented mortality of more than 5.5 million bats in northeastern North America as of 2015 reduces the likelihood of many individuals being present within the onshore portions of the proposed Project area (USFWS 2015). However, given the drastic reduction in cave bat populations in the region, the biological significance of mortality resulting from the proposed Project, if any, may be increased.

3.5.1.2 Impact Level Definitions for Bats

The definitions of potential adverse impact levels for bats are provided in Table 3.5.1-2. There would be no beneficial impacts on bats.

Table 3.5.1-2. Impact level definitions for bats

Impact Level	Impact Type	Definition
Negligible	Adverse	Impacts would be so small as to be unmeasurable.
Minor	Adverse	Most impacts would be avoided; if impacts occur, the loss of one or few individuals or temporary alteration of habitat could represent a minor impact, depending on the time of year and number of individuals involved.
Moderate	Adverse	Impacts are unavoidable but would not result in population-level effects or threaten overall habitat function.
Major	Adverse	Impacts would result in severe, long-term habitat or population-level effects on species.

3.5.1.3 Impacts of Alternative A - No Action on Bats

When analyzing the impacts of the No Action Alternative on bats, BOEM considered the impacts of ongoing activities, including ongoing non-offshore wind and ongoing offshore wind activities on the baseline conditions for bats. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities, as described in Appendix D*, Planned Activities Scenario*.

Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for bats described in Section 3.5.1.1, *Description of the Affected Environment and Future Baseline Conditions*, would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities. Ongoing non-offshore wind activities in the geographic analysis area that contribute to impacts on bats are generally associated with onshore construction and climate change. Onshore construction activities and associated impacts are expected to continue at current trends and have the potential to affect bat species through temporary and permanent habitat removal and temporary noise impacts, which could cause avoidance behavior and displacement. Mortality of individual bats could occur, but population-level effects would not be anticipated. Impacts associated with climate change have the potential to reduce reproductive output and increase individual mortality and disease occurrence.

The following ongoing offshore wind activities in the geographic analysis area contribute to impacts on bats.

- Continued O&M of the Block Island project (five WTGs) installed in state waters.
- Continued O&M of the CVOW-Pilot Project (two WTGs) installed in OCS-A 0497.
- Ongoing construction of multiple offshore wind projects: the Vineyard Wind 1 project (62 WTGs and 1 OSP) in OCS-A 0501, South Fork project (12 WTGs and 1 OSP) in OCS-A 0517, Revolution Wind

project (65 WTGs and two OSPs) in OCS-A 0486, Ocean Wind 1 (98 WTGs and three OSPs) in OCS-A 0498, Empire Wind (147 WTGs and two OSPs) in OCS-A 0512, and CVOW-Commercial (176 WTGs and three OSPs) in OCS-A 0483.

Ongoing O&M of Block Island and CVOW-Pilot projects and ongoing construction of multiple offshore wind projects would affect bats through the primary IPFs of noise, presence of structures, and land disturbance. Ongoing offshore wind activities would have the same type of impacts from noise, presence of structures, and land disturbance that are described in *Cumulative Impacts of the No Action Alternative* for ongoing and planned offshore wind activities, but the impacts would be of lower intensity.

Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impact of the No Action Alternative in combination with other planned non-offshore wind activities and planned offshore wind activities (without the Proposed Action).

Other planned non-offshore wind activities that may affect bats include new submarine cables and pipelines, increasing onshore construction, marine minerals extraction, port expansions, and installation of new structures on the OCS (Appendix D, *Planned Activities Scenario*, for a complete description of planned activities). These activities may result in temporary or permanent displacement and injury or mortality to individual bats, but population-level effects would not be expected.

The following sections summarize the potential impacts of ongoing and planned offshore wind activities on bats during construction, O&M, and decommissioning of the projects. Planned offshore wind activities include offshore wind energy development activities on the Atlantic OCS other than the Proposed Action determined by BOEM to be reasonably foreseeable (see Appendix D, Attachment 2 for a complete description of planned offshore wind activities).

Offshore wind activities may affect bats through the following primary IPFs.

Noise: Anthropogenic noise associated with offshore wind development, including noise from pile-driving and construction activities offshore and construction activities onshore, has the potential to result in impacts on bats. BOEM anticipates that noise impacts would be negligible because noise would be temporary and highly localized. In the planned activities scenario (Appendix D, *Planned Activities Scenario*), the construction of 2,940 offshore structures (other than the Proposed Action) and associated OSPs would create noise and may temporarily affect migrating tree bats, if conducted at night during the spring or fall migration periods.

The greatest impact of noise would likely be caused by pile-driving activities during installation of foundations for offshore wind structures. Noise from pile driving would occur during installation of foundations for offshore structures at a frequency of 4 to 6 hours per day at a time, over an 8-year period. Noise from construction activity would be short-term, temporary, and highly localized. Auditory impacts are not expected to occur, because recent research has shown that bats may be less sensitive to temporary threshold shifts) than other terrestrial mammals (Simmons et al. 2016). Habitat-related impacts (i.e., displacement from potentially suitable habitats) could occur as a result of construction activities, which could generate noise sufficient to cause avoidance behavior by individual migrating tree bats (Schaub et al. 2008). These impacts would likely be limited to behavioral avoidance of pile-driving or construction activity, and no temporary or permanent hearing loss would be expected (Simmons et al. 2016). However, these impacts are highly unlikely to occur, as little use of the OCS is expected, and only during spring and fall migration.

Habitat-related impacts (i.e., displacement from potentially suitable habitats) could occur as a result of construction activities, which could generate noise sufficient to cause avoidance behavior by individual migrating tree bats (Schaub et al. 2008). These impacts would likely be limited to behavioral avoidance of pile-driving or construction activity, and no temporary or permanent hearing loss would be expected (Simmons et al. 2016). However, these impacts are highly unlikely to occur because little use of the OCS is expected by tree bats, and only during spring and fall migration.

Potential for short-term, temporary, localized habitat impacts arising from onshore construction of required offshore wind development infrastructure noise exists; however, no auditory impacts on cave-hibernating or tree bats would be expected to occur. Recent literature suggests that bats are less susceptible to temporary or permanent hearing loss from exposure to intense sounds (Simmons et al. 2016), and bats are tolerant to anthropogenic noise as documented instances have shown bats roosting in noisy environments near airports and highways (Brack et al. 2004). However, nighttime work outside of normal hours may be required on an as-needed basis. Some temporary displacement or avoidance of potentially suitable foraging habitat could occur, but these impacts would not be expected to be biologically significant. Some bats roosting in the vicinity of construction activities may be disturbed during construction but would be expected to move to a different roost farther from the construction noise. This would not be expected to result in any impacts, because frequent roost switching is common among bats (Hann et al. 2017; Whitaker 1998).

Non-routine activities associated with the offshore wind facilities would generally require intense, temporary activity to address emergency conditions. The noise made by onshore construction equipment or offshore repair vessels could temporarily deter bats from approaching the site of a given non-routine event. Impacts on bats, if any, would be temporary and last only as long as repair or remediation activities were necessary to address these non-routine events. Given the temporary and localized nature of potential impacts and the expected biologically insignificant response to those impacts, no individual fitness or population-level impacts would be expected to occur as a result of onshore or offshore noise associated with offshore wind development, and so overall impacts would be negligible.

Presence of structures: Offshore wind-related activities would add up to 2,940 WTGs and OSPs on the OCS that could result in potential impacts on bats. Cave bats are less likely to fly offshore (even during fall migration) (Sjollema et al. 2014); therefore, exposure to construction vessels during construction or maintenance activities, or the rotor-swept zone (RSZ) of operating WTGs in the wind lease areas, is expected to be negligible, if exposure occurs at all (BOEM 2015; Pelletier et al. 2013). Tree bats, however, may pass through the offshore wind lease areas during the fall migration with potential to encounter vessels during construction and decommissioning of WTGs, OSPs, and offshore export cable corridors. During the installation of WTGs at the Block Island Wind Farm, some unidentified bats were observed roosting on the vessels during daytime hours. One photo taken by a crew member during this time captured an eastern red bat roosting below an elevated deck in August (Stantec 2016b).

As discussed above, while bats have been documented on offshore islands, relatively little bat activity has been documented over open-water habitat similar to the conditions in the Lease Area. Several authors, such as Cryan and Barclay (2009), Cryan et al. (2014), and Kunz et al. (2007), discuss several hypotheses as to why bats may be attracted to WTGs. Many of these, including the creation of linear corridors, altered habitat conditions, or thermal inversions, would not apply to WTGs on the Atlantic OCS (Cryan and Barclay 2009; Cryan et al. 2014; Kunz et al. 2007). Solick and Newman (2021) suggest the offshore structures may serve as shelter from adverse weather conditions or provide an area to rest from a long flight. Other hypotheses associated with the Atlantic OCS regarding bat attraction to WTGs include bats perceiving the WTGs as potential roosts, potentially increased prey base, visual attraction, disorientation due to electromagnetic fields (EMF) or decompression, or attraction due to mating strategies (Arnett et al. 2008; Cryan 2007; Kunz et al. 2007). However, no definitive answer as to why bats appear to be attracted to WTGs has been postulated, despite intensive studies at onshore wind facilities. Smallwood and Bell (2020) found that bats were twice as likely to travel through the RSZ of active WTGs than inactive ones and were more likely to experience flight interruptions or be struck by blades from active WTGs onshore. As such, it is possible that some migrating bats may encounter, and perhaps be attracted to, operational WTGs and interact with turbine blades in the RSZ (Ahlén et al. 2007; Arnett et al. 2008; Cryan et al. 2014; Cryan and Barclay 2009), in addition to OSP and non-operational WTG towers to opportunistically roost or forage. However, bats’ echolocation abilities and agility make it unlikely that these stationary objects (OSP and non-operational WTGs) or moving vessels would pose a collision risk to migrating individuals; this assumption is supported by the evidence that bat carcasses are rarely found at the bases of onshore turbine towers (Choi et al. 2020).

Tree bat species that may encounter the operating WTGs in the offshore lease areas include the eastern red bat, hoary bat, and silver-haired bat. Offshore O&M would present a seasonal risk factor to migratory tree bats that may use the offshore habitats during fall migration. While some potential exists for migrating tree bats to encounter operating WTGs during fall migration, the overall occurrence of bats on the OCS is relatively very low (Stantec 2016b). Furthermore, unlike with terrestrial migration routes, there are no landscape features that would concentrate bats and thereby increase exposure to the offshore wind lease areas. Given the expected infrequent and limited use of the OCS by migrating tree bats, very few individuals would be expected to encounter operating WTGs or other structures associated with offshore wind development. With the proposed up to 1-nm (1.9-kilometer) spacing between structures associated with offshore wind development in the Massachusetts and Rhode Island lease areas and the distribution of anticipated projects, individual bats migrating over the OCS within the RSZ of project WTGs would likely pass through projects with only slight course corrections, if any, to avoid operating WTGs. Unlike with terrestrial migration routes, there are no landscape features that would concentrate migrating tree bats and increase exposure to offshore wind lease areas on the OCS (Baerwald and Barclay 2009; Cryan and Barclay 2009; Fiedler 2004; Hamilton 2012; Smith and

McWilliams 2016). Additionally, the potential collision risk to migrating tree bats varies with climatic conditions. For example, bat activity is associated with relatively low wind speeds and warm temperatures (Arnett et al. 2008; Cryan and Brown 2007; Fiedler 2004; Kerns et al. 2005). Given the rarity of tree bats in the offshore environment, WTGs being widely spaced, and the patchiness of projects, the likelihood of collisions is expected to be low and impacts on bats would be negligible. Additionally, the likelihood of a migrating individual encountering one or more operating WTGs during adverse weather conditions would be extremely low, because bat activity is suppressed during periods of strong winds, low temperatures, and rain (Arnett et al. 2008; Erickson et al. 2002).

Land disturbance (onshore construction): Onshore construction of offshore wind development infrastructure would be required over the next 8 years and has the potential to result in impacts due to habitat loss or fragmentation. However, onshore construction would be expected to account for only a very small increase in development relative to other ongoing development activities. Construction would be expected to require only small amounts of habitat removal, if any, and would occur in previously disturbed areas to the extent possible. As such, onshore construction impacts associated with offshore wind development would be short term and minor and no injury or mortality of individual bats would be expected. Furthermore, no individual or population-level effects are expected to occur. As such, onshore construction impacts associated with offshore wind development would not be expected to appreciably contribute to overall impacts on bats.

In addition to electrical infrastructure, some amount of habitat conversion may result from port expansion activities required to meet the demands for fabrication, construction, transportation, and installation of wind energy structures. The general trend along the coastal region from Virginia to Maine is that port activity will increase modestly and require some conversion of undeveloped land to meet port demand. This conversion will result in permanent habitat loss for local bat populations. However, the incremental increase from offshore wind development would be a minimal contribution in the port expansion required to meet increased commercial, industrial, and recreational demand (BOEM 2019).

Impacts of Alternative A on ESA-Listed Species

The northern long-eared bat is the only bat species listed under the ESA that may be affected by offshore wind activities. As described above, northern long-eared bats are not expected to use the OCS in any significant numbers, if at all. The IPFs described previously for all bats would also apply to the northern long-eared bat. Any future federal activities that could affect the northern long-eared bat would need to comply with ESA Section 7 to ensure that the proposed activities do not jeopardize the continued existence of the species.

Conclusions

Impacts of the No Action Alternative: Under the No Action Alternative, bats would continue to be affected by existing environmental trends and ongoing activities. Ongoing activities are expected to have continuing temporary and permanent impacts (disturbance, displacement, injury, mortality, and habitat conversion) on bats primarily through the onshore construction impacts, the presence of structures, and climate change. Given the infrequent and limited anticipated use of the OCS by migrating tree bats during spring and fall migration and given that cave bats do not typically occur on the OCS, ongoing offshore wind activities would not appreciably contribute to impacts on bats. Temporary disturbance and permanent loss of habitat onshore may occur as a result of offshore wind development. However, habitat removal is anticipated to be minimal, and any impacts resulting from habitat loss or disturbance would not be expected to result in individual fitness or population-level effects within the geographic analysis area. The No Action Alternative would result in **minor adverse** impacts on bats.

Cumulative Impacts of the No Action Alternative: Under the No Action Alternative, existing environmental trends and ongoing activities would continue, and bats would continue to be affected by natural and human-caused IPFs. Planned activities would contribute to the impacts on bats due to habitat loss from increased onshore construction. Due to limited anticipated bat presence on the OCS and minimal expected onshore bat habitat impacts, BOEM anticipates cumulative impacts of the No Action Alternative would likely be **minor adverse** because any impacts on bats would be too small to be measurable.

3.5.1.4 Relevant Design Parameters and Potential Variances in Impacts

This EIS analyzes the maximum-case scenario; any potential variances in the proposed Project buildout as defined in the PDE would result in impacts similar to or less than those described in the following sections. The following proposed PDE parameters (Appendix C, *Project Design Envelope and Maximum-Case Scenario*) would influence the magnitude of the impacts on bats.

- The onshore substation/converter station sites, which could require the removal of forested habitat.
- The number, size, and location of WTGs.
- The routing variants within the selected onshore cable export route.
- The time of year during which construction occurs.

Variability of the proposed project design exists as outlined in Appendix C. Below is a summary of potential variances in impacts.

- Number of WTGs, size, and location: the level of hazard related to WTGs is proportional to the number of WTGs installed; fewer WTGs would present less hazard to bats.
- Onshore export cable routes and substation/converter stations footprints: the route chosen (including variants within the general route) and substation/converter stations footprint would determine the amount of habitat affected.
- Season of construction: the active season for bats in this area is from April through October. Construction outside of this window would have a lesser impact on bats than construction during the active season.

SouthCoast Wind has committed to measures to minimize impacts on bats, including avoiding locating onshore facilities near known hibernacula and roosting colonies, minimizing lighting to reduce potential attraction of bats to vessels and vehicles during construction, and developing and implementing a Post-

Construction Monitoring Plan to evaluate and mitigate for potential collision risk for bat species (Appendix G, *Mitigation and Monitoring*). SouthCoast Wind's *Draft Post-Construction Avian and Bat Monitoring Framework* is provided as Attachment G-3 in Appendix G.

3.5.1.5 Impacts of Alternative B - Proposed Action on Bats

The following sections summarize the potential impacts of the Proposed Action on bats during construction, O&M, and decommissioning phases.

Noise: Pile-driving noise and onshore and offshore construction noise associated with the Proposed Action alone is expected to result in short-term, temporary, negligible, and highly localized impacts. The Proposed Action would include a maximum of 149 WTG/OSP positions. Each WTG requires one monopile or three to eight pin piles, and each OSP requires one monopile or up to 27 pin piles with each pin pile or monopile requiring 2 or 4 hours of driving to install, respectively. Auditory impacts are not expected to occur; recent research has shown that bats may be less sensitive to temporary threshold shifts than other terrestrial mammals (Simmons et al. 2016). Impacts, if any, are expected to be limited to behavioral avoidance of pile-driving or construction activity, and no temporary or permanent hearing loss would be expected (Simmons et al. 2016).

Normal operation of the substation/converter stations may generate a small amount of noise into the surrounding environment. Operational noise, however, is expected to be significantly less than noise associated with construction and bats are not likely to be sensitive to such disturbances. COP Appendix U1, *In-Air Acoustic Assessment*, Table 5-1 and Table 5-2 provides the primary noise sources and reference levels for substation sites and HDD operations, respectively. To avoid, mitigate, and minimize noise impacts during onshore construction activities, SouthCoast Wind would require construction equipment to be operated such that the construction-related noise levels comply with applicable sections of the MassDEP Air Quality Regulation at 310 CMR 7.10, which would minimize impacts on bats (COP Appendix U1, In-Air Acoustic Assessment Report, Section 5.2.3).

Presence of structures: Migration disturbance and turbine strikes are impacts on bats that could result from the presence of structures in the OCS and are described in detail in Section 3.5.1.3, *Impacts of Alternative A – No Action on Bats*. Up to 149 WTG/OSP positions on the OCS could contain structures resulting from the Proposed Action where few currently exist. The structures and associated bat impacts would have the potential to occur until decommissioning is complete. There is currently some uncertainty regarding the level of bat use of the OCS and the ultimate consequences of mortality, if any, associated with operating WTGs. However, existing data from meteorological buoys provide the best opportunity to further define bat use of open-water habitat far from shore where SouthCoast Wind would site the Proposed Action's WTGs. Relatively few (372) bat passes were detected at meteorological buoy sites, and use was sporadic when compared to sites on offshore islands (Stantec 2016b). In addition, recent data from 3 years of post-construction monitoring around Block Island Wind Farm found relatively low numbers of bats present only during the fall, and no recorded presence of northern long-eared bats (Stantec 2020). While many of the bats that were detected around Block Island Wind Farm were present at wind speeds below SouthCoast Wind's proposed WTG cut-in speed of 5.6–8.9

miles per hour, there were a number of bats present at or above the cut-in speed, which could indicate vulnerability for bats when WTG blades are turning. However, as previously mentioned, available data indicate that bat activity levels are generally lower offshore compared to onshore (Hein et al. 2021). Migratory tree-roosting bats have been recorded 21.0 and 27.0 miles (33.8 and 44.5 kilometers) offshore but are unlikely to be exposed to WTGs within the Lease Area, which is 29.8 miles (48.0 kilometers) south of Martha's Vineyard, 23.0 miles (37.0 kilometers) south of Nantucket, and 44.7 miles (72.0 kilometers) from the mainland at Nobska Point in Falmouth, Massachusetts. Therefore, because bat presence on the OCS is limited, BOEM anticipates the presence of structures to have a negligible impact on bat populations.

Land disturbance (onshore construction): Impacts associated with construction of onshore elements of the Proposed Action could occur if construction activities occur during the active season (generally, April through October). These impacts may result in displacement or direct injury or death of bat species in the onshore Project area through tree trimming or removal, or the disruption of bat activity resulting in roost abandonment or significant energy expenditure during pup-rearing or migratory periods. Tree trimming and clearing could potentially cause injury or mortality of individuals, particularly juveniles who are unable to flush from a roost, if occupied by bats at the time of removal. Additionally, there would be some potential loss of potentially suitable roosting or foraging habitat. However, impacts to bat habitat from onshore construction would be limited because SouthCoast Wind's facilities would follow previously disturbed areas, which would result in no further additional habitat fragmentation, significant new open spaces, or open corridors. Where necessary, construction of onshore facilities may require clearing and permanent removal of some trees along the edge of the construction corridor. The sites of the HVDC Brayton Point converter stations and, if Falmouth is selected as the POI for Project 2, the Falmouth substation would be located in previously disturbed areas, which are not likely to provide suitable habitat for summer foraging and/or roosting. Overall, onshore construction disturbances are expected to be short-term for bats but would have permanent effects including new aboveground structures and lost habitat from limited tree clearing required for the onshore substation and/or converter stations. Additionally, routine ground disturbance would likely occur during O&M near the onshore converter stations/substation. This would result in permanent alteration of natural habitats, which were disturbed prior during the construction phase. To avoid and minimize impacts on bats, SouthCoast Wind proposes siting onshore infrastructure away from key habitat locations for cave-hibernating species. Onshore export cables would be underground from the landfall locations to the onshore substation and/or converter stations, and the onshore substation and/or converter stations would be constructed in open areas where tree clearing is expected to be minimal. SouthCoast Wind would coordinate as necessary with USFWS, the Massachusetts Division of Fish and Wildlife, and RIDEM to determine appropriate mitigation measures, and by adhering to seasonal restrictions, the risk of direct mortality or injury during construction would be avoided.

BOEM anticipates that impacts would be minor given the limited amount of habitat removal and that any potential impact would be avoided or significantly reduced due to SouthCoast Wind's proposed Project's AMMs. Therefore, impacts would not result in individual fitness or population-level effects.

Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned non-offshore wind and offshore wind activities. Ongoing and planned non-offshore wind activities related to submarine cables and pipelines, onshore construction, marine minerals extraction, and port expansions would contribute to impacts on bats through the primary IPFs of noise, presence of structures, and land disturbance. The construction, O&M, and decommissioning of both onshore and offshore infrastructure for offshore wind activities across the geographic analysis area would also contribute to the primary IPFs of noise, presence of structures, and land disturbance. Given the infrequent and limited anticipated use of the OCS by migrating tree bats and given that cave bats do not typically occur on the OCS, offshore wind activities would not appreciably contribute to impacts on bats. Temporary disturbance and permanent loss of onshore habitat may occur as a result of constructing onshore infrastructure such as onshore substations and onshore export cables for offshore wind development. However, habitat removal is anticipated to be minimal, and any impacts resulting from habitat loss or disturbance would not be expected to result in individual fitness of population-level effects in the geographic analysis area. Ongoing and planned offshore wind activities in combination with the Proposed Action would result in an estimated 2,940 WTGs and OSPs, of which the Proposed Action would contribute 149 or about 5 percent.

The cumulative impacts on bats would likely be minor because the occurrence of bats offshore is low, and onshore habitat loss is expected to be minimal. In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the cumulative noise, presence of structures, and land disturbance impacts on bats.

Impacts of Alternative B on ESA-Listed Species

The northern long-eared bat is the only bat species listed under the ESA that may be affected by the proposed Project. As stated previously, the presence of northern long-eared bat on the offshore environment would generally be limited, with more potential effects from onshore activities. BOEM prepared a BA analyzing the effects of the Project on USFWS federally listed species. There is no critical habitat designated for northern long-eared bat in the action area defined in the BA. Consultation with USFWS pursuant to Section 7 of the ESA concluded on September 1, 2023, and results of the consultation are included in the following *Conclusion* section.

Conclusions

Impacts of the Proposed Action: BOEM anticipates construction and installation, O&M, and conceptual decommissioning of the Proposed Action would have overall **minor** impacts on bats, especially if tree clearing is conducted outside the active season. The primary risks would be from potential onshore removal of habitat and operation of the offshore WTGs, which could lead to negligible to minor long-term impacts in the form of mortality, although BOEM anticipates this to be rare. Noise effects from construction are expected to be limited to temporary and localized behavioral avoidance of pile-driving or construction activity that would cease once construction is complete.

BOEM prepared a BA assessing the potential effects on federally listed species (BOEM 2023). Consultation with USFWS pursuant to Section 7 of the ESA was concluded September 1, 2023. In USFWS's transmittal letter for the Biological Opinion, USFWS concurred with BOEM's determination of may affect, but is not likely to adversely affect, for the northern long-eared bat (endangered) and the tricolored bat (proposed endangered) (USFWS 2023).

Cumulative Impacts of the Proposed Action: The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned activities, including offshore wind activities. The contribution of the Proposed Action to the cumulative impacts of individual IPFs resulting from ongoing and planned activities would be expected to be minor. The primary IPFs are noise, presence of structures, and land disturbance. Considering all the IPFs together, due to the limited anticipated bat presence on the OCS and minimal expected onshore bat habitat impacts, BOEM anticipates that the cumulative impacts on bats in the geographic analysis area would be **minor** because any impacts on bats would be too small to be measurable. Impacts of Alternative C on Bats

Impacts of Alternative C: Under Alternative C, the export cable route to Brayton Point would be rerouted onshore to avoid sensitive fish habitat in the Sakonnet River. The new overland portions of Alternative C-1 and Alternative C-2 would largely be sited in public road ROWs to the extent possible.

Alternative C-1 would increase the total onshore export cable route by 9 miles (14 kilometers) compared to the Proposed Action. The increase of land disturbance would require a longer construction schedule due to the complexity of working in developed areas with multiple property owners along the proposed route. Additionally, Alternative C-1 would pass through coastal communities that are popular tourist destinations in the summer months which may lead to seasonal limitations on construction. The combination of a slower rate of progress and seasonal restrictions would result in a significantly longer construction period for onshore cable runs.

The primary impacts of Alternative C affecting bats would be habitat loss from tree disturbance, which would result in both temporary and permanent impacts. In addition to the forest area disturbed under the Proposed Action, 4.95 acres, 2.59 acres, and 15.46 acres of forest habitat could be disturbed under Alternative C-1 (eastern variation), Alternative C-1 (western variation), and Alternative C-2, respectively (refer to Section 3.5.4, *Coastal Habitat and Fauna*). This impact may affect bat foraging, roosting, or maternity colonies. While the area of forest disturbance would be greater than the Proposed Action, the potential impact on bats would remain minor.

Cumulative Impacts of Alternative C: In the context of reasonably foreseeable environmental trends, cumulative impacts of Alternative C would be similar to those described under the Proposed Action.

Impacts of Alternative C on ESA-Listed Species

Under Alternative C, the impact conclusion for the northern long-eared bat is the same as the Proposed Action. Under Alternative C, potential impacts on the northern long-eared bat include habitat loss from forest disturbance, which may be used by this species for foraging, roosting, or maternity colonies.

While the area of forest disturbance would be slightly greater under Alternative C compared to the Proposed Action, it is not anticipated to change the overall impact level.

Conclusions

Impacts of Alternative C: The anticipated minor impacts associated with the Project would not change substantially under Alternative C. While Alternative C would result in a greater area of forest disturbance along the onshore export cable routes than the Proposed Action, the overall affected area would be small and the same construction, O&M, and decommissioning impacts would still occur. Alternative C would have overall **minor adverse** impacts on bats.

Cumulative Impacts of Alternative C: In context of reasonably foreseeable environmental trends, cumulative impacts of Alternative C to the cumulative impacts on bats would be similar to the Proposed Action and would be **minor adverse**. This impact rating is driven primarily by ongoing activities, as well as minor disturbance and habitat removal associated with onshore construction of Alternative C.

3.5.1.6 Impacts of Alternatives D (Preferred Alternative), E, and F on Bats

Impacts of Alternatives D, E, and F: Impacts on bats resulting from construction and installation, O&M, and decommissioning of the Project under Alternatives D, E, and F would be the same as those described for the Proposed Action. Under Alternative D, potential impacts on bats from the presence of structures could be reduced with the removal of six WTGs, but any such differences compared to the Proposed Action would likely be immeasurable. None of the differences between Alternatives E and F and the Proposed Action would have the potential to significantly reduce or increase impacts on bats from the analyzed IPFs. Given the infrequent and limited use of the OCS by bats during the spring and fall migration, BOEM does not anticipate impacts to be materially different than those described for the Proposed Action.

Cumulative Impacts of Alternatives D, E, and F: In the context of reasonably foreseeable environmental trends, cumulative impacts of Alternatives D, E, and F would be similar to those described for the Proposed Action.

Impacts of Alternatives D, E, and F on ESA-Listed Species

Under Alternatives D, E, and F, the impact conclusion for the northern long-eared bat is the same as the Proposed Action for the same reasons described for all bats above. Northern long-eared bats are not expected to use the OCS in any significant numbers, if at all, and BOEM does not anticipate impacts to be measurably different than those described for the Proposed Action.

Conclusions

Impacts of Alternatives D, E, and F: All conclusions reached for the Proposed Action regarding impacts on bats and the ESA-listed northern long-eared bat would also apply to Alternatives D, E, and F. Alternative D would reduce the number of WTGs and noise impacts compared to the Proposed Action in the northern Lease Area but would have similar overall impacts on bats. Alternatives E and F would have the same WTG number and overall Wind Farm Area footprint as the Proposed Action and would have similar impacts on bats. Therefore, the overall **minor adverse** impacts would be similar among the Proposed Action and Alternatives D, E, and F.

Cumulative Impacts of Alternatives D, E, and F: In context of reasonably foreseeable environmental trends, cumulative impacts of Alternatives D, E, and F would be similar to those described for the Proposed Action and would be **minor adverse** due to the anticipated bat presence on the OCS and minimal expected onshore bat habitat impacts, and because any impacts on bats would be too small to be measurable.

3.5.1.7 Comparison of Alternatives

Potential impacts on bats from the other action alternatives would be the same or substantially similar to each other and to the Proposed Action. Therefore, none of the differences among the different alternatives and the Proposed Action would have the potential to significantly increase or decrease impacts on bats onshore or offshore.

3.5.1.8 Proposed Mitigation Measures

Additional mitigation measures identified by BOEM and cooperating agencies as a condition of state and federal permitting, or through agency-to-agency negotiations, are described in detail in Appendix G, Tables G-2 through G-4 and summarized and assessed in Table 3.5.1-3. If one or more of the measures analyzed here are adopted by BOEM or cooperating agencies, some adverse impacts on bats could be further reduced. The Draft EIS analyzed two BOEM-proposed bird and bat mitigation measures, that were subsequently incorporated into the ESA consultation and are now reflected in Appendix G, Table G-2 (i.e., adaptive mitigation for birds and bats, and annual bird and bat mortality reporting).

Table 3.5.1-3. Mitigation and Monitoring Measures Resulting from Consultations (also identified in Appendix G, Table G-2): bats

Measure	Description	Effect
Conservation Measures and Reasonable and Prudent Measures from Terms and Conditions from the USFWS Biological Opinion	USFWS Conservation Recommendations, Reasonable and Prudent Measures, and Terms and Conditions were transmitted by letter dated September 1, 2023. Conservation Recommendations under BOEM, BSEE, and USFWS jurisdiction include light impact reduction, Avian and Bat Post-Construction Monitoring Plan, and Incidental Mortality and Reporting.	Measures required through the ESA consultation would likely result in reduced potential impacts on bats. Should post-construction monitoring show impacts on bats deviate substantially from the impact analysis in the EIS, measures would be implemented to address the specific impact reported.

Measures Incorporated in the Preferred Alternative

Mitigation measures required through completed consultations, authorizations, and permits listed in Table 3.5.1-3 and Tables G-2 through G-4 in Appendix G are incorporated in the Preferred Alternative. These measures would further define how the effectiveness and enforcement of environmental protection measures would be ensured and improve accountability for compliance with environmental protection measures by requiring monitoring, reporting, and adaptive management of potential bat impacts on the OCS. However, given the infrequent and limited anticipated use of the OCS by migrating tree bats during spring and fall migration, and given that cave bats do not typically occur on the OCS, offshore wind activities are unlikely to appreciably contribute to impacts on bats regardless of measures intended to address potential offshore bat impacts. In the onshore environment, tree-clearing restrictions and post-construction monitoring and reporting would ensure impacts on bats and their habitats would be avoided and minimized to the extent practicable. Because these measures ensure the effectiveness of and compliance with environmental protection measures that are already analyzed as part of the Proposed Action, these measures would not further reduce the impact level of the Proposed Action from what is described in Section 3.5.1.5, *Impacts of Alternative B – Proposed Action on Bats*.

3.5 Biological Resources

3.5.2 Benthic Resources

This section discusses potential impacts on benthic resources, other than fishes and commercially important benthic invertebrates, from the proposed Project, alternatives, and ongoing and planned activities in the geographic analysis area. The benthic geographic analysis area, as shown on Figure 3.5.2-1 includes both a 10-mile (16.1-kilometer) radius/buffer around the Wind Farm Area and a 330-foot (100-meter) buffer around each ECC. Finfish, invertebrates, and essential fish habitat are addressed in Section 3.5.5.

3.5.2.1 Description of the Affected Environment

The description of benthic resources in this section is supported by studies conducted by SouthCoast Wind, as well as other studies reviewed in the literature (COP Section 6.6, Appendix M, and Appendix K; SouthCoast Wind 2024). Seasonal benthic surveys were conducted in the Lease Area and along the Falmouth ECC to characterize the benthic resources in the Offshore Project area (SouthCoast Wind 2024). Benthic habitat surveys conducted for the proposed Project included Sediment Profile Imaging (SPI)/Plan View (PV) imagery data, and benthic grab samples throughout the Offshore Project area. Benthic epifaunal and infaunal species abundance were analyzed using benthic grabs as well as seafloor imagery captured by the benthic survey SPI/PV camera and a video camera that was affixed to the benthic grab apparatus. Submerged aquatic vegetation (SAV) surveys consisting of single-beam echo sounding, side-scan sonar, and underwater towed video were completed at three landfall location options in Falmouth, Massachusetts (SouthCoast Wind 2024). Two landfall locations are under consideration for the Brayton Point ECC where a previously unmapped section of interpreted SAV was identified near the shoreline closest to the Aquidneck Island landfall (COP Appendix E; SouthCoast Wind 2024).[1]

A larger-scale, non-Project-specific study was also undertaken that characterized offshore wind lease areas in the northeast WEAs (Guida et al. 2017). This study compiled data from numerous sources, including from NOAA-National Centers for Environmental Information for bathymetric data, NEFSC for physical and biological oceanography, NEFSC fisheries independent trawl survey for demersal fish and shellfish, and USGS usSEABED data for surficial sediment data (USGS 2005).

[1] As described in Chapter 2, Section 2.1.2, *Alternative B – Proposed Action,* Brayton Point is the preferred ECC for both Project 1 and Project 2, and Falmouth is the variant ECC for Project 2, which would be used if SouthCoast Wind is prevented from using Brayton Point for Project 2.

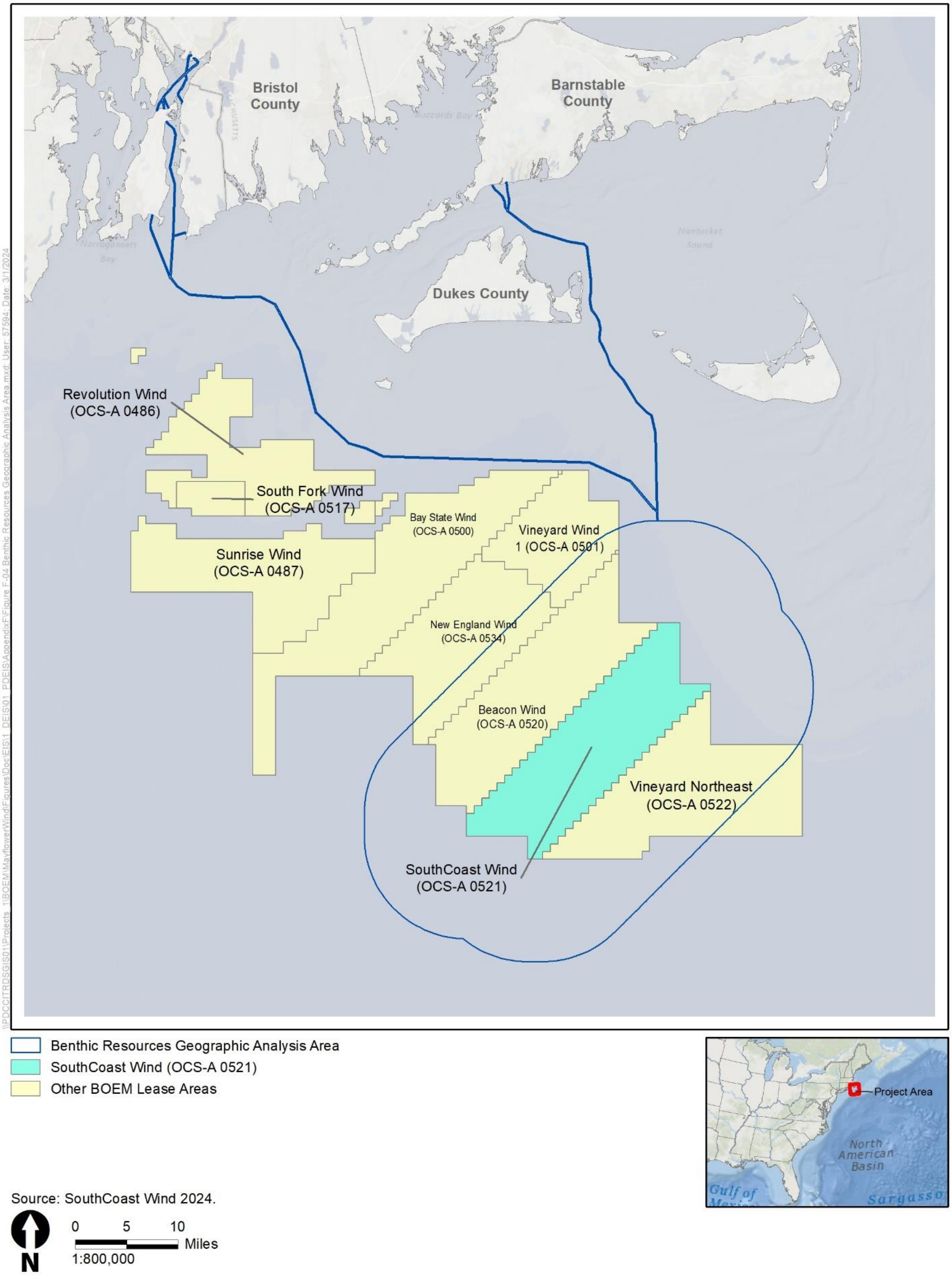


Figure 3.5.2-1. Benthic resources geographic analysis area

Offshore Project Area

The Wind Farm Area covers approximately 127,388 acres (51,552 hectares) on the Northeast Outer Continental Shelf off the southern coast of Massachusetts (SouthCoast Wind 2024), with up to two ECCs extending from the Wind Farm Area to Brayton Point in Somerset, Massachusetts, and to the Falmouth, Massachusetts, coastline. The seafloor of the Wind Farm Area is mostly flat with gentle slopes ranging from less than 1.0° to 4.9°. The central section of the Lease Area comprises ridges with moderate slopes (5.0° to 9.9°) and shallow channels (SouthCoast Wind 2024). Water depths within the Lease Area range from 121.72 feet (37.1 meters) to 208.3 feet (63.5 meters), with deeper waters in the southwestern portion. The average depth is 164.0 feet (50.0 meters), and the deepest depth is 206.7 feet (63.1 meters) (SouthCoast Wind 2024). There are no hard corals within the vicinity of the Lease Area according to the NOAA Deep-Sea Coral Data Portal (NOAA 2022), and only sea pens were documented in the 1960s south of the Lease Area in deeper waters (SouthCoast Wind 2024).

Benthic resources include the seafloor, substrate, and communities of bottom-dwelling organisms that live within these habitats. Benthic habitats include soft-bottom (i.e., unconsolidated sediments) and hard-bottom (e.g., cobble and boulder) habitats, as well as consolidated sediment (i.e., pavement), which can occur in scour zones, and biogenic habitats (e.g., eelgrass and worm tubes) created by structure-forming species. Sediments from grab samples in the Lease Area were largely classified as Coastal and Marine Ecological Classification Standard (CMECS) Subclass Fine Unconsolidated Substrate, or dominated by sand or finer sediment size (<5 percent gravel). Only one sample was classified as Coarse Unconsolidated Substrate (≥5 percent gravel; SouthCoast Wind 2024). The Lease Area was mainly soft-bottom habitat with little relief and no complex habitat-forming features. Total organic carbon (TOC) was low with the majority of samples containing less than 1 percent TOC.

Benthic epifauna were sampled by beam trawl across the Massachusetts offshore wind Lease Area with sand shrimp and sand dollars comprising 88 percent of individuals collected (Guida et al. 2017). Mobile crustaceans and mollusks were dominant in 2020 benthic samples and are commonly associated with the soft sediments of the Lease Area (SouthCoast Wind 2024). Infaunal communities of the Lease Area consisted mainly of soft-sediment burrowing infauna, with the eastern portion consisting of clam beds and tube-building *Ampelisca* beds (SouthCoast Wind 2024). The western portion of the Lease Area also contained *Ampelisca* beds, as well as small surface-burrowing polychaete worm beds. Results of a seagrass and macroalgae evaluation of the Offshore Project area found no SAV in the Lease Area. Refer to Table 3.5.5-2 in Section 3.5.5 for types and acres of habitat in the Lease Area.

Inshore Project Area

The Falmouth ECC extends from the Lease Area through Muskeget Channel and ends at one of the two proposed landfall locations in Falmouth, Massachusetts (Worcester Avenue with alternate sites at Shore Street and Central Park). The Brayton Point ECC extends from the Lease Area through the Rhode Island Sound, up the Sakonnet River, over Aquidneck Island, and into Mount Hope Bay before making landfall at one of the two proposed locations in Somerset, Massachusetts.

Similar to the Lease Area, the southern portion of the Falmouth ECC (between the Lease Area and the Muskeget Channel) consisted mainly of fine and soft sediments. Samples in this southern section were mainly Fine Unconsolidated sediment, with three samples as Coarse Unconsolidated sediment (≥5 percent gravel; SouthCoast Wind 2024). Most samples (approximately 90 percent) were sand, with three samples consisting of Muddy Sand (COP Appendix M; SouthCoast Wind 2024). Further sand classification indicated a transition of Fine/Very Fine Sand to Medium and Very Coarse/Coarse Sand as sampling occurred more north and away from the Lease Area. The only complex habitats observed were from three gravelly samples just south of the Muskeget Channel along the Falmouth ECC from stations 031 (41.30701, -70.33827), 032 (41.29463, -70.33827), and 124 (41.23198, -70.31761) (COP Appendix M3). TOC was less than 1 percent in all samples (COP Appendix M; SouthCoast Wind 2024).

The northern Falmouth ECC sediment samples were more variable, with a further transition to coarser sediments as the corridor proceeds north through the Muskeget Channel toward the Nantucket Sound and landfall. Gravelly samples dominated the Muskeget Channel and south of the Nantucket Sound Main Channel, with a transition to soft-bottom habitat as all samples within the Nantucket Sound Main Channel were classified as sand (SouthCoast Wind 2024). Complex habitat was observed in the remaining samples north of the Nantucket Main Channel, with two samples classified as Biogenic Shell Substrate (*Crepidula* reef). Some Gravel Pavement was noted in the SPI/PV images, and Gravel/Gravelly samples were observed throughout the northern section of the Falmouth ECC. TOC was undetectable in the majority of samples, with one sample containing slightly above 1 percent.

A benthic survey was conducted along the Brayton Point ECC in Summer 2021 and Spring 2022. Sediments followed similar patterns as the Falmouth ECC, with finer sediments in the southern section near the Lease Area becoming coarser as sampling proceeded north. In federal waters, over 90 percent of benthic habitat was mapped as sand or finer (Appendix M.3; SouthCoast Wind 2024). Gravelly Sand to Sandy Gravel, including Boulders, were present in the Rhode Island Sound where an area of glacial till southwest of Martha's Vineyard provides heterogeneous substrate and hard-bottom substrate (COP Volume 2, Section 6.6.1.6.4; SouthCoast Wind 2024). Sand or finer sediments dominated Rhode Island state waters as well making up 88 percent of the benthic habitat. Coarse sediments consisting of Mixed-Sized Gravel in Muddy Sand/Sand followed at 8.5 percent while Glacial Moraine A and Bedrock made up 3.1 and 0.1 percent of benthic habitats, respectively (Appendix M.3; SouthCoast Wind 2024). Additionally, 22.2 percent of the Rhode Island state waters had Crepidula Substrate as a CMECS Substrate classifier, and 3.1 percent had Boulder Field(s) as a Substrate classifier (Appendix M.3; SouthCoast Wind 2024). Sediments in the Sakonnet River were finer sands to silts with areas of boulders, including anthropogenic rock dumps that provide hard-bottom habitat, and isolated mounds associated with *Crepidula* reefs (SouthCoast Wind 2024; USGS 2005).

The infauna sampled along the southern Falmouth ECC closely matched the eastern Lease Area, dominated by clam beds and large tube-building fauna. The northern Falmouth ECC had a heterogeneous array of species including soft-sediment bryozoans and mobile burrowing crustaceans (SouthCoast Wind 2024). Sampling within the Brayton Point ECC showed soft-sediment fauna was the dominant CMECS biotic subclass observed along the entire Brayton Point ECC, characterized by clam beds, larger tube-building, mobile crustaceans, and surface-burrowing fauna, with much more diversity in the southern portion of the ECC.

SAV beds were identified at the Falmouth landfall areas from a review of eelgrass field surveys completed in August 2020 (SouthCoast Wind 2024). The seagrass and macroalgae characterization surveys did not identify SAV in the southern portion of the Falmouth ECC, but macroalgae was identified in approximately two-thirds of the survey locations during benthic grabs of the northern section of the Falmouth ECC (COP Appendix K and Appendix M; SouthCoast Wind 2024). A previously unmapped section of interpreted SAV was identified near the Aquidneck Island landfall of the Brayton Point ECC (COP Appendix E; SouthCoast Wind 2024). Refer to Section 3.5.5, Table 3.5.5-2 to Table 3.5.5-5 for types and acres of habitat in the ECCs.

3.5.2.2 Impact Level Definitions for Benthic Resources

Impact level definitions for benthic resources are provided in Table 3.5.2-1.

Table 3.5.2-1. Definitions of impact levels for benthic resources

Impact Level	Type of Impact	Definition
Negligible	Adverse	Impacts on species or habitat would be adverse, but so small as to be unmeasurable.
	Beneficial	Impacts on species or habitat would be beneficial, but so small as to be unmeasurable.
Minor	Adverse	Most adverse impacts on species would be avoided. Adverse impacts on sensitive habitats would be avoided; adverse impacts that do occur would be temporary or short term in nature.
	Beneficial	If beneficial impacts occur, they may result in a benefit to some individuals and would be temporary to short term in nature.
Moderate	Adverse	Adverse impacts on species would be unavoidable but would not result in population-level effects. Adverse impacts on habitat may be short term, long term, or permanent and may include impacts on sensitive habitats, but would not result in population-level effects on species that rely on them.
	Beneficial	Beneficial impacts on species would not result in population-level effects. Beneficial impacts on habitat may be short term, long term, or permanent, but would not result in population-level benefits to species that rely on them.
Major	Adverse	Adverse impacts would affect the viability of the population and would not be fully recoverable. Adverse impacts on habitats would result in population-level impacts on species that rely on them.
	Beneficial	Beneficial impacts would promote the viability of the affected population or increase population resiliency. Beneficial impacts on habitats would result in population-level benefits to species that rely on them.

3.5.2.3 Impacts of Alternative A – No Action on Benthic Resources

When analyzing the impacts of the No Action Alternative on benthic resources, BOEM considered the impacts of ongoing activities, including ongoing non-offshore wind and ongoing offshore wind activities on the baseline conditions for benthic resources. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities, as described in Appendix D*, Planned Activities Scenario*.

Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for benthic resources described in Section 3.5.2.1, *Description of the Affected Environment and Future Baseline Conditions,* would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities. Ongoing non-offshore wind activities in the geographic analysis area that contribute to impacts on benthic resources are generally associated with inshore dredging, coastal development, offshore construction, including bottom disturbance and habitat conversion, and climate change. Regular vessel anchoring related to ongoing military, survey, commercial, and recreational activities would continue to cause temporary to permanent direct (injury to or mortality of organisms and physical damage to habitats) and indirect (increased turbidity) impacts in the immediate area where anchors and chains meet the seafloor. Cable emplacement and maintenance activities cause infrequent disturbance to benthic resources and short-term increases in suspended fine sediments as well as sediment deposition. EMFs continuously emanate from existing undersea telecommunication and electrical power transmission cables, and new cables are infrequently installed in the geographic analysis area. Underwater noise impacts occur due to pile driving, which periodically occurs in nearshore areas during construction and repair of piers, bridges, pilings, and seawalls. The presence of structures can be detrimental to benthic organisms due to habitat conversion and lost fishing gear, which can cause disturbance, injury, and loss, or could be beneficial by serving to provide relief and habitat to structure-oriented fishes and invertebrates. Ongoing commercial and recreational fishing for finfish and shellfish that disturbs the seafloor (e.g., trawling and dredging) would continue to affect benthic resources in the foreseeable future. Increased port utilization and expansion would result in more numerous vessel visits and cause increased vessel noise and increased suspended sediment concentrations. Ongoing sediment dredging for navigational purposes and other activities that cause seabed profile alterations would result in fine sediment resuspension and deposition, habitat alteration, and injury to and mortality of benthic resources.

Impacts associated with climate change (ocean acidification and warming, sea level rise, altered habitat/ecology) have the potential to alter species distributions and increase individual mortality and disease occurrence. Increased sea temperatures have been shown to affect the natural ecology of the ocean, including benthic resources. Sea surface temperatures along the Atlantic coast increased by 1°C (34°F) since 1960 (Friedland and Hare 2007) and continue to rise. Ocean acidification caused by atmospheric CO_2 may contribute to reduced settlement, growth, and reproduction of benthic resources such as echinoderms, crustaceans, corals, and bivalves (Kurihara 2008). Warming of ocean waters is expected to influence the distribution and migration of benthic resources and may influence the frequencies of various diseases (Hoegh-Guldberg and Bruno 2010; Brothers et al. 2016).

The geographic analysis area overlaps a portion of the Vineyard Wind 1 project in OCS-A 0501, which has an approved COP. Ongoing construction of the Vineyard Wind 1 project would affect benthic resources through the primary IPFs of accidental releases, cable emplacement and maintenance, noise, and land disturbance. Ongoing offshore wind activities would have the same type of impacts that are described in *Cumulative Impacts of the No Action Alternative* for ongoing and planned offshore wind activities, but the impacts would be of lower intensity. Regarding benthic impacts specific to Muskeget Channel, after BOEM's COP approval of Vineyard Wind 1, Vineyard Wind 1 selected the Eastern Muskeget route for the offshore export cable route. Hard/complex bottoms cover much of the Muskeget area (BOEM 2021a). The maximum total area of hard/complex bottom and rugged seafloor that exists within the installation corridor in Muskeget Channel for the Eastern Muskeget route is approximately 1,520 acres (615 hectares) (BOEM 2021a). The total disturbance area of hard-bottom/coarse deposits, complex seafloor/sand waves, and biogenic surfaces within the Eastern Muskeget route is 28.8 acres (11.7 hectares), or a relatively small subset of this area (BOEM 2021a). The total temporarily disturbed area of hard-bottom/coarse deposits, complex seafloor/sand waves, and biogenic surfaces within the Eastern Muskeget route is 1,424 acres (576 hectares), which is estimated as sediment deposition greater than 1 millimeter that may extend up to 328 feet (100 meters) from the proposed cable installation (BOEM 2021a).

Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impact of the No Action Alternative in combination with other planned non-offshore wind activities and planned offshore wind activities (without the Proposed Action).

Planned non-offshore wind activities that may affect benthic resources include new submarine cables and pipelines, oil and gas activities, marine minerals extraction, port expansions, and installation of new structures on the OCS (see Appendix D, *Planned Activities Scenario*, for a complete description of planned activities). Impacts from planned non-offshore wind activities would be similar to those from ongoing activities and may include temporary and permanent impacts on benthic resources from disturbance, injury, mortality, habitat degradation, and habitat conversion. While these impacts would have localized effects on benthic resources, population-level effects would not be expected.

The following sections summarize the potential impacts of ongoing and planned offshore wind activities in the geographic analysis area on benthic resources during construction, O&M, and decommissioning of the projects. In addition to the ongoing construction of the Vineyard Wind 1 project, the geographic analysis area overlaps other planned and ongoing offshore wind activities including the entirety of OCS-A 0520 (Beacon Wind) and portions of OCS-A 0534 (New England Wind) and OCS-A 0522 (Vineyard Wind Northeast). BOEM expects other offshore wind activities to affect benthic resources through the following primary IPFs.

Accidental releases: Accidental releases may increase due to offshore wind activities, with gradually increasing vessel traffic over the next 35 years. The risk of any type of accidental release would be increased primarily during construction, but also during operations and decommissioning of offshore wind facilities. Accidental releases of hazardous materials mostly consist of fuels, lubricating oils, and other petroleum compounds. Because most of these materials tend to float in seawater, they are unlikely to contact benthic resources. The chemicals with potential to sink or dissolve rapidly are predicted to dilute to non-toxic levels before they reach benthic resources (BOEM 2021a). In most cases, the corresponding impacts on benthic resources are unlikely to be detectable unless there is a catastrophic spill (e.g., an accident involving a tanker ship). Large-scale spills may be accompanied by the use of chemical dispersants during post-spill response. Crude oil treated with dispersants (specifically Corexit 9500A) has been shown to have higher toxicity to marine zooplankton and meroplankton than either the crude oil or dispersant alone (Rico-Martinez et al. 2012; Almeda et al. 2014a, 2014b). Benthic resources with planktonic larval stages may be susceptible to this toxicity, which may affect subsequent recruitment.

Nonnative or invasive species can be accidentally released in the discharge of ballast water and bilge water during vessel activities. Increased vessel traffic throughout the construction phase of offshore wind projects would increase the risk of accidental releases of invasive species. 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 National Pollutant Discharge Elimination System Vessel General Permit standards, both of which aim at least in part to prevent the release and movement of invasive species. Adherence to these regulations would reduce the likelihood of discharge of ballast or bilge water contaminated with invasive species. Invasive species also have the potential to use foundations, scour protection, and any other novel hard substrate as steppingstones to expand their geographic range (Adams et al. 2014). Ten invasive species were observed to expand their range using foundations at an operational wind farm in Europe, with the majority occurring in the intertidal and only two invasive species observed in the subtidal (De Mesel et al. 2015). Although the likelihood of invasive species becoming established due to offshore wind-related activities is low, the impacts of invasive species could be strongly adverse, widespread, and permanent if the species were to become established and out-compete native fauna. Indirect impacts could result from competition with invasive species for food or habitat, and/or loss of foraging opportunities if preferred prey is no longer available due to competition with invasive species. The increase in this risk related to the offshore wind industry would be small in comparison to the risk from ongoing activities (e.g., trans-oceanic shipping). Accidental releases of trash and debris may occur from vessels primarily during construction, but also during operations and decommissioning. BOEM assumes all vessels would comply with laws and regulations to minimize releases. If a release were to occur, it would be an accidental, localized event in the vicinity of work areas. The greatest likelihood of releases would be associated with nearshore project activities (e.g., transmission cable installation and transport of equipment and personnel from ports). However, there is no evidence that the anticipated volumes and extents would have detectable impacts on benthic resources.

The overall impacts of accidental releases on benthic resources are likely to be minor because large-scale releases are unlikely and impacts from small-scale releases would be localized and short term, resulting in little change to benthic resources. As such, accidental releases from offshore wind development would not be expected to appreciably contribute to overall impacts on benthic resources.

Anchoring: Offshore wind activities would increase vessel anchoring during survey activities and during construction, installation, maintenance, and decommissioning of offshore components. In addition, anchored or moored meteorological towers or buoys could also increase in number. Anchoring would result in increased levels of turbidity and would have the potential to cause mortality of some benthic resources through physical contact. Using the assumptions in Appendix D, Table D2-2, anchoring could affect up to 1,008 acres (408 hectares) of seabed from ongoing and planned offshore wind projects in the geographic analysis area. Most impacts would be minor because impacts would be localized, turbidity would be temporary, and mortality of benthic resources from contact would be recovered in the short-term. Degradation of sensitive habitats and resources, such as eelgrass beds and hard-bottom habitats, if it occurs, could be long-term to permanent, resulting in moderate impacts.

Cable emplacement and maintenance: New construction of offshore submarine cables would cause short-term disturbance of seafloor habitats and injury and mortality of benthic resources in the immediate vicinity of the cable emplacement activities. The cable routes for other offshore wind projects have not been fully determined at this time. However, at least one other ongoing offshore wind project will be installing export cables through complex habitats within Muskeget Channel – New England Wind. As stated in the final EIS for New England Wind, New England Wind's offshore export cable corridor is largely the same as the corridor already approved by BOEM for Vineyard Wind 1 (see *Impacts of the No Action Alternative*). As such, impacts on benthic habitats are anticipated to be similar to Vineyard Wind 1. Both export and interarray cables are anticipated to be constructed through 2030 for other offshore wind projects with lease areas that are within or overlap the geographic analysis area (Appendix D, Table D2-1). The total area disturbed from new cable emplacement would be a small fraction of available habitat in the geographic analysis area and would be expected to recover relatively quickly. Impacts associated with cable emplacement in sensitive habitats such as areas with SAV or complex habitat such as cobble and boulders, where present, may take longer to recover. No SAV disturbance is expected from Vineyard Wind 1 or New England Wind cable installations (BOEM 2021a, 2022). While direct disturbance of eelgrass would be avoided, sedimentation impacts may occur, which would be temporary and potentially mitigated with the use of turbidity curtains.

Seafloor preparations made prior to installation of structures and cables, and as a result of dredging and mechanical trenching during cable installation, can cause localized, short-term impacts (e.g., habitat alteration, injury, mortality) on benthic resources through seabed profile alterations and sediment deposition. The level of impact from seabed profile alterations could depend on the time of year that they occur, especially if these alterations overlap with times and places of high benthic organism abundance or reproductive activity. However, recolonization rates of benthic habitats are driven by the types of benthic communities inhabiting the area surrounding the affected region. Benthic communities that are well adapted to disturbance within their habitats (e.g., mobile soft sediments) are likely to quickly recolonize a disturbed area. However, communities that are not well adapted to frequent disturbance (e.g., deep boulder epifaunal communities) may take upward of a year to begin recolonization and/or for seabed recovery to occur, and likely more than a year to reach the level of community diversity that existed prior to disturbance. Associated seabed recovery is defined here as the natural infilling of sediment in construction trenches and associated recolonization of epifaunal and benthic infaunal communities to support pre-disturbance ecological function, which will vary by species and nature of the disturbance. For example, benthic communities disturbed by sand mining was examined on the East Coast of the United States, and Brooks et al. (2006) found that seabed recovery and/or recolonization ranged from 3 months to 2.5 years.

Locations, amounts, and timing of dredging for offshore wind projects are not known at this time. The need for dredging depends on local seafloor conditions, assuming the areal extent of such impacts is proportional to the length of cable installed. Dredging typically occurs only in sandy or silty habitats, which are abundant in the geographic analysis area and are quick to recover from disturbance, although full recovery of the benthic faunal assemblage may require several years (Wilber and Clarke 2007). Mechanical trenching, used in more resistant sediments (e.g., gravel and cobble), causes seabed profile alterations during use, although the seabed is typically restored to its original profile after utility line installation in the trench. Coarser sand and gravel substrates typically take longer to recover to pre-disturbance conditions than habitats with finer grain sizes (Wilber and Clarke 2007). The installation of WTG foundations and hard surfaces such as scour and cable protection will alter local hydrodynamic patterns. This may have a resulting impact on local sedimentation and sediment migration patterns. Impacts would be minor because seabed profile alterations, while locally intense, have little impact on benthic resources in the geographic analysis area.

Cable emplacement and maintenance activities (including dredging) in or near the geographic analysis area could cause sediment suspension during periods of active construction or maintenance, after which the sediment would be deposited on the seafloor. Sediment deposition can result in adverse impacts on benthic resources, including smothering and changes to sediment quality profiles. The tolerance of benthic organisms to being covered by sediment (sedimentation) varies among species. Demersal winter flounder eggs were shown to have delayed hatching with as little as 0.04 inch (1 millimeter) of sedimentation (Berry et al. 2011). The sensitivity to sedimentation for shellfish varies by species and life stage. Some sessile shellfish may only tolerate 0.4–0.8 inch (1–2 centimeters) while other benthic organisms can survive burial in upward of 8 inches (20 centimeters) (Essink 1999). Areas closest to the disturbance would receive higher percentages of coarser, more rapidly settling sediments, while finer sediments would settle over greater distances and be more diffused. The greatest impacts would, therefore, be at the smallest spatial scales. The level of impact from sediment deposition and burial could depend on the time of year that it occurs, especially if it overlaps with times and places of high benthic organism abundance or reproductive activity.

Increased turbidity would occur during cable emplacement activities over the course of the construction of the wind farms in the geographic analysis area. Disturbed seafloor from construction of these projects may affect benthic resources. Assuming other offshore wind projects use installation procedures similar to those proposed in the COP, the duration and extent of impacts would be limited and short term, and benthic assemblages would recover from disturbance. In routes that intersect sensitive or complex habitat, impacts may be long term to permanent. For SAV, damage to seagrass blades may be more quickly recovered; however, damage to or uprooting of rhizomes may take years to recover from (Orth et al. 2017). Modeled simulations of dragging impacts on eelgrass further suggested recovery of eelgrass beds may take 6 years, and 20 years or longer under conditions less conducive to eelgrass growth (Neckles et al. 2005). Increased turbidity due to bottom disturbances associated with cable emplacement would reduce light availability to SAV. This short- to long-term impact would be most pronounced in the immediate vicinity of the disturbance. However, while mitigating impacts on SAV including eelgrass presents challenges, mitigation measures taken in or near the geographic analysis area may include HDD and/or turbidity curtains.

When new cable emplacement and maintenance causes resuspension of sediments, increased turbidity could also have an adverse impact on filter-feeding fauna such as bivalves. Within the Massachusetts/Rhode Island lease areas, sand is the predominant sediment type, which would settle out of the water column quickly (Guida et al. 2017). There are lower percentages of finer sediments (mud) that would stay suspended longer and, therefore, travel farther. The impact of increased turbidity on benthic fauna depends on both the concentration of suspended sediment and the duration of exposure. Plume modeling for other wind development projects in the region and with similar sediment characteristics (Vineyard Wind 1, Block Island Wind Farm, and Virginia Offshore Wind Technology Advancement) predict suspended sediment should usually settle well before 12 hours have elapsed. BOEM expects relatively little impact from increased turbidity (separate from the impact of sediment deposition).

Some types of cable installation equipment use water withdrawals, which can entrain planktonic larvae of benthic fauna (e.g., larval polychaetes, mollusks, crustaceans) with assumed 100 percent mortality of entrained individuals. Due to the surface-oriented intake, water withdrawal could entrain pelagic eggs and larvae but would not affect resources on the seafloor. However, the rate of egg and larval survival to adulthood for many species is very low (MMS 2009). Due to the limited volume of water withdrawn, BOEM does not expect population-level impacts on any given benthic species. If the sediment that would be disturbed by construction activities contains elevated levels of toxic contaminants, sediment disturbances could affect water quality and the physiology of benthic organisms. Contaminated sediments are not known to be a problem in the geographic analysis area for benthic resources.

Cable routes for other offshore wind projects have not been fully determined at this time. Cables for other offshore wind projects in the geographic analysis area would likely be emplaced between 2025 and 2030. Locations, amounts, and timing of dredging for offshore wind projects are not known at this time. Increased sediment deposition may occur during multiple years. The area with a greater sediment deposition from simultaneous or sequential activities would be limited, as most of the affected areas would only be lightly sedimented (less than 0.04 inch [1 millimeter]) and would recover naturally in the short term. Dredged material disposal during construction, if any occurs in the geographic analysis area, would cause localized, temporary turbidity increases and long-term sedimentation or burial of benthic organisms at the immediate disposal site. The impacts of burial would be mostly short term with less potential for long-term impacts. Sediment deposition and burial impacts on benthic resources from cable emplacement for other offshore wind projects would, therefore, be moderate.

Overall, impacts through this IPF would be minor to moderate because they would be localized, turbidity would be present during construction for brief periods, and mortality from contact would be recovered in the short term. Any necessary dredging prior to cable installation could also contribute additional impacts.

Discharges/intakes: There would be increased potential for discharges from vessels during construction, operations, and decommissioning. Offshore-permitted discharges would include uncontaminated bilge water and treated liquid wastes. There would be an increase in discharges, particularly during construction and decommissioning when vessel traffic would be highest, and the discharges would be staggered over time and localized. Impacts would be negligible because there does not appear to be evidence that the volumes and extents anticipated would have any impact on benthic resources.

EMFs: The marine environment continuously generates a variable ambient EMFs. EMFs would also emanate from new offshore ECCs and interarray cables constructed for offshore wind projects. Offshore wind projects in the geographic analysis area will add 2,285 miles (3,677 kilometers) of cable that would produce EMFs in the immediate vicinity of cables for each project during operation (Appendix D, Table D2-1). Offshore export cable design options for Vineyard Wind 1 include either a 220–275 kV HVAC or one bundled 320–500 kV HVDC. Vineyard Wind 1 also plans to use a 66–132 kV HVAC cable design for interarray cables. BOEM would require these future submarine power cables to have appropriate shielding and burial depth to minimize potential EMF effects from cable operation. Remedial protection measures would be installed wherever the target burial depths cannot be met. EMF and substrate heating effects from these projects on benthic habitats would vary in extent and significance depending on overall cable length, the proportion of buried versus exposed cable segments, project-specific transmission design (e.g., HVAC or HVDC, transmission voltage), and the proximity of the affected habitat to the cable. For example, species with life stages that are surface-oriented or use pelagic habitats would not be exposed to EMF effects and would experience no effects on this habitat component. In contrast, species that use bottom or near-bottom habitats along the potential cable paths during one or more life stages may be exposed to EMF effects. The significance of these potential effects is dependent on habitat use (i.e., likelihood of exposure) and species-specific sensitivity to magnetic and electrical fields and heating effects. EMF strength diminishes rapidly with distance, and the area around submarine power cables with elevated EMF levels extends less than approximately 33 feet (10 meters) around each cable (CSA Ocean Sciences, Inc. and Exponent 2019). When submarine cables are laid, installers typically maintain a minimum separation distance of at least 330 feet (100 meters) from other known cables to avoid inadvertent damage during installation, which also precludes any additive EMF effects from adjacent cables.

Impacts of EMFs on benthic habitats is an emerging field of study; as a result, there is a high degree of uncertainty regarding the nature and magnitude of effects on all potential receptors (Gill and Desender 2020). Recent reviews by Bilinski (2021), Gill and Desender (2020), Albert et al. (2020), and Snyder et al. (2019) on the effects of EMF on marine organisms in field and laboratory studies concluded that, though minimal, measurable effects can occur for some species, but not at the relatively low EMF intensities representative of marine renewable energy projects. Behavioral impacts from EMFs, observed at higher levels than are representative of offshore wind projects, were documented for lobsters near a direct current cable (Hutchison et al. 2018) and a domestic electrical power cable (Hutchison et al. 2020), which included subtle changes in activity (e.g., broader search areas, subtle effects on positioning, and a tendency to cluster near the EMF source). There was no evidence of the cable acting as a barrier to lobster movement, and no effects were observed on lobster movement speed or distance traveled. Additionally, responses to EMFs by benthic marine fauna include attraction to the source, interference with navigation that relies on natural magnetic fields, predator/prey interactions, avoidance or attraction behaviors, increased burrowing by polychaetes, increased exploratory and foraging behavior, and physiological and developmental effects (Bilinski 2021; Jakubowska et al. 2019; Hutchison et al. 2018; Taormina et al. 2018; Normandeau et al. 2011). Burrowing infauna may be exposed to stronger EMFs, but little information is available regarding the potential consequences. Non-mobile infauna would be unable to move to avoid EMFs. Any effects, however, would be local and would not have population-level impacts due to the small scale of the impact relative to the available benthic habitat in the geographic analysis area.

Other studies, however, have found that EMFs do not affect invertebrate behavior. For example, Schultz et al. (2010) and Woodruff et al. (2012, 2013) conducted laboratory experiments exposing American lobster (*Homarus americanus*) and Dungeness crab (*Metacarcinus magister*) to EMFs ranging from 3,000 to 10,000 milligauss and found that EMFs did not affect their behavior. Assuming the other wind projects with HVAC cables in the geographic analysis area have similar array and export cable voltages as the Proposed Action, the induced magnetic field levels expected for the offshore wind projects are two to three orders of magnitude lower than those tested by Schultz et al. (2010) and Woodruff et al. (2012, 2013). Similarly, a field experiment in Southern California and Puget Sound, Washington, found no evidence that the catchability of two crab species was influenced by the animals crossing an energized low-frequency alternating-current submarine power cable (35 and 69 kV, respectively) to enter a baited trap. Whether the cables were unburied or lightly buried did not influence the crab responses (Love et al. 2017). While these voltages are between two and eight times lower than those expected for the offshore wind projects, the array and export cables would be shielded and buried at depth to reduce potential EMFs during cable operation.

EMF levels would be highest at the seabed near cable segments that cannot be fully buried and are laid on the bed surface under protective rock or concrete blankets. Invertebrates in proximity to these areas could experience detectable EMF levels and minimal associated behavioral effects. These unburied cable segments would be short and widely dispersed. CSA Ocean Sciences, Inc. and Exponent (2019) found that offshore wind energy development as currently proposed would have negligible effects, if any, on bottom-dwelling species. The information presented above indicates that EMF impacts on benthic fauna would be biologically insignificant, highly localized, and limited to the immediate vicinity of cables, and would be undetectable beyond a short distance; however, localized impacts would persist as long as cables are in operation (anticipated to be around 35 years or until decommissioning). The affected area would represent an insignificant portion of the available benthic habitat; therefore, EMF impacts from other offshore wind activities on benthic resources would be minor.

Gear utilization: Benthic and fisheries monitoring surveys are usually conducted pre-, during, and post-construction of offshore wind projects as part of their Benthic and Fisheries Monitoring Plans. These surveys can have direct impacts on benthic habitats. Bottom-disturbing trawls can alter the composition and complexity of soft-bottom benthic habitats. For example, when trawl gear contacts the seabed it can flatten sand ripples, remove epifaunal organisms and biogenic structures like worm tubes, and expose anaerobic sediments (BOEM 2022). Fishing activity used in some fish surveys can damage benthic invertebrates on hard-bottom benthic habitat, resulting in long-term effects on community composition and complexity (Tamsett et al. 2010). Towed sampling dredges often used for clam surveys would cause localized and direct impacts on both hard- and soft-bottom habitat, resulting in potentially long-term effects on community composition. Soft-bottom impacts would be short term and expected to recover quickly. Because the affected area would represent a small area of the available benthic habitat in the geographic analysis area, cumulative impacts from gear utilization on benthic resources would be negligible to minor.

Noise: Sound from offshore wind activities includes sound pressure, particle motion, and vibration. Sound pressure is the fluctuation in the density of the medium (e.g., sediments) due to the sound, particle motion refers to the movement of particles that make up the medium during that sound, and vibrations are initiated by direct contact of a sound source with the substrate, such as during pile driving, and by sound energy entering the substrate through the water from intense sources, such as seismic air guns (Popper et al. 2022). Most fishes, including all elasmobranchs and likely all sound-detecting invertebrates, primarily detect sound via particle motion (Popper et al. 2022; Carroll et al. 2017). Fishes and aquatic invertebrates that live in, on, or close to the substrate (e.g., the seabed) may also be affected by vibrations. Sound pressure and particle motion can also emanate from the substrate back into the water column as a result of such vibrations (Hawkins et al. 2021). In a review of potential impacts of sound on fishes and aquatic invertebrates from offshore wind activities, Popper et al. (2022) identified substantial gaps in the understanding of these effects and concluded these gaps preclude an assessment of the potential impacts of sound from offshore development.

The current body of research and existing regulations have mostly focused on sound pressure as opposed to particle motion. Guidelines based on sound pressure may not be applicable for most fishes and invertebrates, especially in shallow water (Popper and Hawkins 2018). Measures of sound pressure cannot be used to reliably describe particle motion, especially in a complex acoustic environment such as the ocean. Because of this focus on sound pressure, modeling of sound propagation has a notable data gap, especially when dealing with fish and invertebrates (Hawkins and Popper 2017).

Numerous invertebrate species have been found to be sensitive to noise. Many species sense noise through the use of a statolith organ, which detects particle motion through a dense statocyst. Anthropogenic sound exposure has been found to result in delayed hatching and impaired embryonic development in crustaceans, bivalves, and gastropods. Permanent high-level exposure to sound has also been found to cause a significant reduction in the rate of growth and reproduction in invertebrate groups (Sole et al. 2023) and physiological stress in echinoderms (Vazzana et al. 2020). Bivalves have been found to close their valves and burrow deeper when subjected to noise and vibration stimuli, reducing respiration and other processes, and potentially causing mortality (Roberts et al. 2016). With impulse impacts, such as those from pile driving, physiological sound thresholds may be exceeded for some species, resulting in injury or mortality, especially for affected species in the immediate vicinity of the activity. However, the duration of pile driving and its small radius of potential effects on infaunal organisms are expected to last on the order of hours. Noise transmitted through water or the seabed sediments would also be expected to affect benthic invertebrates. However, data are not available to adequately quantify these impacts (Popper et al. 2022).

Noise from construction, pile driving, G&G survey activities, O&M, and trenching/cable burial could contribute to impacts on benthic resources. The most impactful noise is expected to result from pile driving. Noise from pile driving would occur during installation of foundations for offshore structures. This noise would be produced intermittently during installation of each foundation. One or more projects may install more than one foundation per day, either sequentially or simultaneously. Construction of offshore wind facilities in the geographic analysis area would likely occur over an assumed 5-year construction period, with up to 585 WTGs (Appendix D, Table D2-1). Noise transmitted through water and through the seabed can cause injury to or mortality of benthic resources in a limited area around each pile and can cause short-term stress and behavioral changes to individuals over a greater area. The extent depends on pile size, hammer energy, and local acoustic conditions. The affected areas would likely be recolonized in the short-term. In the planned activities scenario, noise from pile driving that causes behavioral changes could affect the same populations or individuals multiple times in a year or in sequential years, although impacts are expected to be minor.

Noise from G&G surveys of cable routes and other site characterization surveys for offshore wind facilities could also disturb benthic resources in the immediate vicinity of the investigation and cause temporary behavioral changes. G&G noise would occur intermittently over an assumed 5-year construction period (Appendix D, Table D2-1). G&G noise resulting from offshore wind site characterization surveys is less intense than G&G noise from seismic surveys used in oil and gas exploration. While seismic surveys create high-intensity, impulsive noise to penetrate deep into the seabed, offshore wind site characterization surveys typically use sub-bottom profiling technologies that generate less-intense sound waves for shallow penetration of the seabed. Seismic surveys are not expected in the geographic analysis area. Detectable impacts of G&G noise on benthic resources would rarely, if ever, overlap from multiple sources, but may overlap with behavioral impacts of pile-driving noise if two projects were being developed concurrently. Overlapping sound sources are not anticipated to result in a greater, more-intense sound; rather, the louder sound prevents the softer sound from being detected. Noise from G&G surveys is therefore expected to have a minor impact on benthic resources.

Noise from trenching/cable burial, O&M, and construction activities other than pile driving is expected to occur but would have little impact on benthic resources. Noise from interarray and export cable trenching would be temporary and localized and extend only a short distance beyond the emplacement corridor. Impacts of trenching noise are typically less prominent than the impacts of the physical disturbances discussed under the *Cable emplacement and maintenance* IPF. Finally, while noise associated with operational WTGs may be audible to some benthic fauna, this would only occur at relatively short distances from the WTG foundations and could cause avoidance responses (English et al. 2017). Proximity to the individual turbines is the strongest predictor of SPLs over factors such as wind speed and turbine size (Tourgaard et al. 2020). Vibration is also produced by operation of WTGs.

Vibrations are transmitted into the water and seabed by the WTG support structure. The substrate vibration can be continuous when the wind turbine is operating, though the area affected by the particle motion is restricted to an area close to the wind turbine (Hawkins et al. 2021). Noise from construction activities other than pile driving may occur; however, little of that noise propagates for any substantial distance through the water, and, therefore, impacts on benthic resources are expected to be minor.

Port utilization: Increases in port utilization due to other offshore wind projects would lead to increased vessel traffic over the next 35 years. This increase in vessel traffic would be at its peak during construction activities between 2023 and 2030 and would decrease during operations but increase again during decommissioning (Appendix D, Table D2-1). In addition, any port-expansion and construction activities related to the additional offshore wind projects would add to the total amount of disturbed benthic area resulting in disturbance and mortality of individuals and short-term to permanent habitat alteration. Existing ports are heavily modified and have impaired benthic environments. Future port projects would likely implement BMPs to minimize impacts on benthic habitats (e.g., stormwater management and turbidity curtains). The degree of impacts on benthic resources would likely be undetectable outside the immediate vicinity of the port-expansion activities. Increased vessel traffic around ports would also increase physical impacts of vessel operation, including impacts of wakes on shallow and shoreline habitats as well as erosion, scour, and turbidity impacts from vessels operating in shallower inshore waters.

Impacts of port utilization associated with planned wind-related activities would be localized and range from short term and minor (for water quality and vessel noise impacts) to permanent and moderate (for port-expansion activities that heavily modify benthic environments).

Presence of structures: The presence of structures can lead to impacts on benthic resources through fishing gear entanglement, hydrodynamic disturbance, fish aggregation resulting in increased predation on benthic resources, and habitat conversion. Invasive species also have the potential to use foundations as steppingstones to expand their geographic range (Adams et al. 2014). These impacts may arise from foundations and scour/cable protection. Ongoing and planned offshore wind development would add up to 944 acres (382 hectares) of foundation and scour protection and 772 acres (312 hectares) of new hard protection atop cables (Appendix D, Table D2-2). In the geographic analysis area, structures are anticipated predominantly on sandy bottom, with the exception of cable protection, which is more likely to be needed where cables pass through hard-bottom habitats. The potential locations of cable protection for other offshore wind activities have not been fully determined at this time; however, any addition of scour protection/hard-bottom habitat would represent substantial new hard-bottom habitat, as the geographic analysis area is predominantly composed of fine substrates. Installation of these structures would result in direct mortality of benthic organisms within the footprint of disturbance, suspension of sediments, increased turbidity, and burial of benthic organisms in immediate proximity to foundations or below scour/cable protection.

The presence of structures would increase the risk of gear loss or damage by entanglement. Fishing gear potentially entangled or lost on underwater structures includes mesh from trawls or other similar nets, traps, and angling gear (e.g., fishing line, hooks, lures with hooks). Lost gear actively continues to fish and may drift with currents. Marine organisms may become trapped or ensnared in lost or drifting gear, also known as "ghost" fishing gear, leading to injury or mortality. The intermittent impacts at any one location would likely be localized and short-term, although the risk of occurrence would persist as long as the structures and debris remain.

Human-made structures, especially tall vertical structures such as foundations, alter local water flow (hydrodynamics) at a fine scale by potentially reducing wind-driven mixing of surface waters or increasing vertical mixing as water flows around the structure (Carpenter et al. 2016; Cazenave et al. 2016; Segtnan and Christakos 2015). Increased mixing may also result in warmer bottom temperatures, increasing stress on some shellfish and fish at the southern or inshore extent of the range of suitable temperatures. Finfish aggregate trends along the mid-Atlantic shelf have been shifting northeast into deeper waters (NOAA 2022); the presence of structures may reinforce these trends. The consequences for benthic resources from hydrodynamic disturbances are anticipated to be undetectable to small, localized, and vary seasonally. Additional, detailed discussion of the hydrodynamic effects of offshore wind structures is contained in Section 3.5.5.3, *Impacts of Alternative A – No Action on Benthic Resources*. Structures, including tower foundations, scour protection around foundations, and various means of hard protection atop cables, create uncommon vertical relief in a mostly soft-bottom landscape. Structure-oriented fishes would be attracted to these locations. Increased predation upon benthic resources by structure-oriented fishes could adversely affect benthic communities in the immediate vicinity of the structure. These impacts are expected to be local and to persist as long as the structures remain. Depending on the balance of attraction and production, newly placed structures may affect the distribution of fish and shellfish among existing natural habitat, artificial reef sites, and newly emplaced structures.

The presence of structures would also result in new hard surfaces that could provide new habitat for recruitment of hard-bottom species (Daigle 2011). The increased local density of fish and shellfish may result in changes to sediment quality through the bio-deposition of organic matter and sloughing off of shells and attached organisms from the structures. New structures also have the potential to facilitate range expansion of both native and nonnative aquatic species through the stepping-stone effect. Colonization and recruitment of marine fauna to structures can result in the dispersion and propagation of nonnative species, especially in nearshore habitats. Like other biofouling organisms, nonnative species might be transported to WTGs via construction and maintenance vessels (Bray et al. 2017; Wilding et al. 2017). Structures may serve as "stepping stones" that connect otherwise unconnected areas and provide a means for nonnative species to disperse and colonize new areas that may have previously been inaccessible due to biogeographical barriers (Adams et al. 2014; Wilding et al. 2017; Bray et al. 2017). Connectivity created among structures, especially where nonnative and invasive species may be present, can alter habitats and adversely affect native species, including federally protected species. At the scale of planned offshore wind activities, the artificial reef effect could lead to regional changes, including a shift from soft-sediment to hard-substrate communities and, potentially, intertidal communities (Causon and Gill 2018). Due to the pre-existing network of artificial reefs in the mid-Atlantic OCS, however, it is unlikely that additional structures would measurably increase the potential for this effect.

Soft bottom is the dominant habitat type in the region, and species that rely on this habitat would not likely experience population-level impacts (Guida et al. 2017; Greene et al. 2010). The potential effects of wind farms on offshore ecosystem functioning have been studied using simulations calibrated with field observations (Raoux et al. 2017; Pezy et al. 2018). These studies found increased biomass for benthic fish and invertebrates. However, some impacts such as the loss of soft-bottom habitat and increased predation pressure on forage species near the structures, may be moderate adverse to moderate beneficial depending on the receptor. In light of the above information, BOEM anticipates that the impacts associated with the presence of structures may be minor to moderately beneficial. The impacts on benthic resources resulting from the presence of structures would persist at least as long as the structures remain.

Impacts of Alternative A on ESA-Listed Species

No benthic species in the geographic analysis area are ESA-Listed; therefore, there will be no impacts on ESA-Listed species from Alternative A.

Conclusions

Impacts of the No Action Alternative: Under the No Action Alternative, benthic resources would continue to be affected by existing environmental trends and ongoing activities. BOEM expects ongoing activities to have continuing short-term, long-term, and permanent impacts (e.g., disturbance, injury, mortality, habitat degradation, habitat conversion) on benthic resources primarily through regular maritime activity, offshore construction impacts, cable emplacement, presence of structures, and climate change. Offshore wind activities are expected to involve several IPFs, primarily new cable emplacement and the presence of structures (i.e., foundations and scour/cable protection). However, habitat disturbance from offshore construction is expected to be minimal, and recovery of benthic communities is expected over time. BOEM anticipates the No Action Alternative to result in **moderate adverse** impacts on benthic resources.

Cumulative Impacts of the No Action Alternative: Under the No Action Alternative, existing environmental trends and ongoing activities would continue, and benthic resources would continue to be affected by natural and human-caused IPFs. Planned activities would contribute to the impacts on benthic resources through pile-driving noise, anchoring, new cable emplacement, the presence of structures during operations of offshore facilities (i.e., foundations, cable, and scour protection), climate change, and ongoing seafloor disturbances caused by sediment dredging and fishing using bottom-tending gear. Considering all of the IPFs together, BOEM anticipates that the No Action Alternative, when combined with planned non-offshore wind activities and other offshore wind activities would result in **moderate adverse** impacts and could potentially include **moderate beneficial** impacts resulting from emplacement of structures (conversion of habitat from soft to hard bottom).

3.5.2.4 Relevant Design Parameters and Potential Variances in Impacts

This EIS analyzes the maximum-case scenario; any potential variances in the proposed Project build-out as defined in the PDE would result in impacts similar to or less than those described in the sections below. The following proposed PDE parameters (Appendix C, *Project Design Envelope and Maximum-Case Scenario*) would influence the magnitude of the impacts on benthic resources.

- The total amount of scour protection for the foundations, interarray cables, and offshore ECCs that results in long-term habitat alteration.
- The installation method of the export cable in the offshore ECCs and for interarray and interlink cables in the Wind Farm Area and the resulting amount of habitat temporarily altered.
- The number and type of foundations used for the WTGs and OSPs.
- The methods used for cable laying and landfalls, as well as the types of vessels used and the amount of anchoring.
- The amount of pre-cable-laying dredging or preparation, if any, and its location.
- The time of year when foundation and cable installations occur.

Variability of the proposed Project design exists as outlined in Appendix C. Below is a summary of potential variances in impacts.

- The number, size, location, and amount of scour protection for WTG and OSP foundations: The level of impact related to foundations is proportional to the number of foundations installed; fewer foundations would present less hazard to benthic organisms.
- Offshore ECCs footprints: The route chosen (including variants within the general route) would determine the amount of habitat affected.
- Season of construction: Spring and summer are the primary spawning seasons for many benthic invertebrates and fish that lay demersal eggs. Project activities during these seasons would likely have greater impacts due to localized disruption of these processes and impacts on reproductive processes and sensitive early life stages.

SouthCoast Wind has committed to measures to minimize impacts on benthic resources, including employing industry standard cable burial and cable shielding methods to reduce potential effects on benthic resources, burying cables, where possible, to allow for benthic recolonization after construction is complete, and designing scour protection to reduce sedimentation (COP Volume 2, Table 16-1; SouthCoast Wind 2024).

3.5.2.5 Impacts of Alternative B – Proposed Action on Benthic Resources

The sections below summarize the potential impacts of the Proposed Action on benthic resources during the various phases of the Proposed Action. Routine activities would include construction, O&M, and decommissioning of the Project, as described in Chapter 2, *Alternatives*.

Accidental releases: As discussed in Section 3.5.2.3, *Impacts of Alternative A,* non-routine events such as oil or chemical spills, potentially amplified by the use of chemical dispersants, can have adverse or lethal effects on marine life. However, modeling by Bejarano et al. (2013) predicts that the impact of smaller spills on benthic fauna would be low. Larger spills are unlikely but could have a larger impact on benthic fauna due to adverse effects on water quality (Section 3.4.2, *Water Quality*). The Proposed Action would comply with all laws regulating at-sea discharges of vessel-generated waste to reduce the likelihood of an accidental release. Further, SouthCoast Wind has developed an OSRP with measures to avoid accidental releases and a protocol to respond to such a release. Therefore, accidental releases are considered unlikely and would be quickly mitigated if one were to occur. The increase in vessel traffic associated with the Proposed Action would increase the risk of accidental releases of invasive species. The risk of this type of release would be increased by the additional vessel traffic associated with the Proposed Action, especially traffic from foreign ports, primarily during construction. In total, the Proposed Action would generate approximately 6,600 vessel trips during the construction and installation phase. However, vessels would be required to adhere to existing state and federal regulations related to ballast and bilge water discharge, and adherence to these regulations would reduce the likelihood of discharge of ballast or bilge water contaminated with invasive species. Overall, the potential impacts on benthic resources as described in Section 3.5.2.3, *Impacts of Alternative A – No Action on Benthic Resources,* from accidental releases due to the Proposed Action, should any occur, is expected to be moderate.

Anchoring: Vessel anchoring from the Proposed Action would cause short-term impacts in the immediate area where anchors and chains meet the seafloor, resulting in up to 441.8 acres (178.8 hectares) of seabed disturbance. Impacts on benthic resources would be greatest for sensitive benthic habitats (e.g., eelgrass beds, hard-bottom habitats). All impacts would be localized, turbidity would be temporary, and mortality from physical contact would be recovered in the short-term. Where eelgrass is present within all three landfall locations under consideration for the Falmouth ECC, HDD is proposed to avoid impacts with a punchout location deeper than the deepest eelgrass extent. While anchor placement and chain sweep may damage seagrass blades, anchor drag and retrieval may damage or uproot seagrass rhizomes, which may take years to recover (Orth et al. 2017). While avoidance of impacts on sensitive habitats from anchoring may not always be possible, to minimize anchoring impacts, SouthCoast Wind has committed to avoiding habitat loss to benthic resources during construction by selecting lower impact construction methods, where possible, which would include avoiding anchoring on sensitive habitat (COP Volume 2, Section 16, Table 16-1; SouthCoast Wind 2024). Impacts are anticipated to be minor to moderate.

Cable emplacement and maintenance: Cable emplacement activities would result in mortality, injury, or displacement of benthic fauna in the path of construction as well as possible damage to sensitive habitats such as SAV. SouthCoast Wind would use HDD for the installation of the offshore export cables beneath the shallower nearshore areas at all landfall locations, which is expected to substantially reduce impacts of sediment disturbance on SAV resources and avoid direct physical disturbance to eelgrass at the offshore export cable approach to the Falmouth landfalls. The final cable corridor selection and cable micro-routing within the selected corridor in the northern portion of the Falmouth ECC and Muskeget Channel will further seek to avoid complex habitats that may be expected to have a slower recovery to preconstruction conditions. The presence of eelgrass beds would be considered in the evaluation of export cable corridor landfall locations, and while HDD exit pit dredging is anticipated to disturb the seabed, it would be located outside of eelgrass beds and planned to only disturb 0.10 acre

(404.7 square meters) of benthic area per HDD exit pit (SouthCoast Wind 2024). Based on modeling, turbidity levels associated with the HDD exit pit dredging in Falmouth had concentrations exceeding 100 mg/L (0.0008 lb/gal) at a maximum distance of 188 feet (36 meters) and affecting a cumulative area not exceeding 1 acre (0.4 hectare; SouthCoast Wind 2024). Modeling of HDD exit pit dredge impacts for Brayton Point revealed concentrations exceeding 100 mg/L at a maximum distance of 0.75 mile (1.2 kilometers) and contained within an average of 29 acres (12 hectares). Although an eelgrass burial experiment has shown that increased mortality can occur with sediment burial of 25 percent of the eelgrass blade height over multiple weeks (Mills and Fonseca 2003), the small area of sediment disturbance of each HDD exit pit would have far less sedimentation and would occur temporarily. Eelgrasses are known to tolerate short-term periods of naturally increased turbidity during storm events (Lewis and Erftemeijer 2006), and suspended sediments from HDD are not expected to negatively affect adjacent eelgrass beds.

Within the Project area, SAV presence was found in the northern portion of the Falmouth, Massachusetts ECC and near the shoreline closest to the southern Aquidneck Island landfall. No eelgrass or macroalgae were found to be present in the southern part of the ECCs or the Lease Area (SouthCoast Wind 2024). Under the Proposed Action, there are three landfall locations under consideration for the Falmouth ECC: Worcester Avenue (preferred), Central Park, and Shore Street, with varying degrees of potential impacts on SAV. Continuous SAV bed coverage, consisting primarily of eelgrass was identified on the approach to both Mill Road and the Shore Street landfall sites. SAV at the Worcester Avenue approach was sparsely distributed in comparison with Mill Road and Shore Street with several large areas devoid of SAV. However, shallower depths present at the Worcester Avenue approach allows SAV to extend farther offshore (SouthCoast Wind 2024).

Cable laying and construction would also result in the resuspension and nearby deposition of sediments as discussed in the COP Volume 2, Section 6.6.2.2.1 (SouthCoast Wind 2024). In areas where displaced sediment is thick enough, organisms may be buried, which could result in mortality of benthic organisms through smothering, irritation to respiratory structures, or a reduction in feeding success. However, benthic species have a range of susceptibility to sedimentation based on life stage, mobility, and feeding mechanisms. To assess the potential impacts from cable emplacement (including HDD exit pit), Scour Modeling and Sediment Plume Impact Modeling were conducted (COP Appendix F1 and Appendix F3; SouthCoast Wind 2024). Within all simulated scenarios, the maximum total suspended solids level dropped below 10 mg/L within 2 hours and below 1 mg/L after less than 4 hours (SouthCoast Wind 2024). The redeposition of sediment in the Lease Area and offshore export cable corridors is expected to occur relatively locally. A majority of the released mass is expected to settle quickly and not be transported for long by currents. Deposition thickness which exceeds 0.20 inch (5 millimeters) is limited to a maximum width of 79 feet (24 meters) around each cable route. Within the vicinity of the interarray cables and in deeper sections of the offshore export cable routes, a thicker layer of deposits was observed over a smaller area due to lower current speeds leading to decreased rates of sediment transport away from the cable installation site.

The seafloor would be disturbed by cable trenches, dredging (if required), anchoring, and cable protection. Offshore construction could also cause adverse impacts on benthic communities from loss or conversion of habitat. Based on the activities described in the COP, the Proposed Action may affect SAV at the Falmouth ECC landfall site; however, HDD allows for the cable to go into a punchout location deeper than the deepest extent of eelgrass observed in SAV surveys and avoid direct impacts on any areas with potential to support SAV beds (SouthCoast Wind 2024). Habitat features in the form of ridges and troughs, sand waves, and boulders (greater than 20 inches [50 centimeters]) are present in the Lease Area and ECCs; however, disturbance for cable emplacement would be temporary and short term. Estimates of maximum seabed preparation impacts is estimated as 5 percent sand wave dredging, 10 percent boulder clearance, and a grapnel run over all cable routes within the Lease Area (refer to the EFH Assessment for more detail). This would occur over a total of 302 acres (122 hectares) within the Lease Area between the interarray cable routes (99 acres [40 hectares]) and the two ECCs (203 acres [82 hectares]). Furthermore, cable emplacement and maintenance activities may flatten depressions and small sand waves, temporarily reducing benthic habitat suitability for species within the cable footprint. Prey organisms that use these habitats would also be displaced, potentially affecting habitat suitability for fish species. Trenching may leave behind temporary depressions. The extent of these natural features is difficult to quantify, as they are continually reshaped by natural sediment transport processes. Natural recovery from anthropogenic disturbance is likely to occur within several months of the disturbance, depending on timing relative to winter storm events. Due to their mobility, it is expected that the sand wave profiles would rapidly return after cable installation. Although it is anticipated that hydrodynamics would be altered by the presence of structures, it is not expected that this would be to a degree that prevents the processes of sand wave formation and migration.

Substantial impacts on seagrass outside of the immediate vicinity of the cable routes due to sedimentation from the one-time installation of cables are unlikely. Seagrasses have vertical structure that can accommodate a degree of burial greater than would be expected from the one-time resuspension and settling of dredged material (Lewis and Erftemeijer 2006). In most locations, the affected areas are expected to recover naturally, and impacts associated with jet plow cable installation are expected to recover in a matter of weeks, allowing for rapid recolonization (MMS 2009). Mechanical trenching, which could be used in coarser sediments, could result in more-intense disturbances and a greater width of the impact corridor, and corresponding seabed scars are expected to recover naturally. As with other impacts related to disturbance of benthic habitat, benthic assemblages would be expected to recover in the short term, resulting in negligible impacts on benthic resources.

BOEM expects the Proposed Action to lead to unavoidable, short- to long-term impacts on benthic resources from this IPF. Despite unavoidable mortality, damage, or displacement of invertebrate organisms, the area affected by the construction footprint for interarray cable emplacement would be just 1 percent of the 127,388-acre (51,552-hectare) Lease Area, and the area affected within the ECCs would similarly represent a small fraction of available benthic habitat. BOEM does not expect population-level impacts on benthic species (i.e., generally accepted ecological and fisheries methods would be unable to detect a change in population, which is the number of individuals of a particular species that live within the geographic analysis area) as a result of the Proposed Action. Benthic fauna would recolonize disturbed areas that have not been displaced by new structures in the short term (Byrnes et al. 2004). Impacts may also result from associated sediment deposition and burial. Recovery of seagrass following benthic disturbance may occur over longer time frames, extending into long-term impacts over multiple years.

Sediment in the Lease Area is largely classified as CMECS Subclass Fine Unconsolidated Substrate (Section 3.5.2.1, *Description of the Affected Environment and Future Baseline Conditions*). Array cables in the Lease Area would be installed via hydroplow where possible, with alternative methods to include use of a jetting tool (jetting ROV or jetting sled), vertical injection, mechanical cutting ROV system, and plowing (pre-cut and mechanical). Several of these methods use water withdrawals that could entrain benthic larvae (MMS 2009). Due to the limited duration and area involved, BOEM does not expect population-level impacts. The consequences of increased turbidity caused by this IPF are discussed in Section 3.4.2, *Water Quality*.

Benthic recovery processes are relevant to understanding the likely duration of impacts on benthic resources. Neighboring benthic communities that have similar habitats and assemblages would recolonize disturbed areas. Succession would begin with more mobile, early colonizer species with progression toward a mature assemblage over time. The restoration of marine soft-sediment habitats occurs through a range of physical (e.g., currents, wave action) and biological (e.g., bioturbation, tube building) processes (Dernie et al. 2003). Impacts and recovery times would vary depending on habitat types, which can generally be separated into the high-energy oceanic environment versus the low-energy estuarine environment. In general, physical processes are more important in high-energy environments, while biological processes dominate in low-energy environments. In high-energy environments, repopulation can often be largely attributed to bedload transport of adult and juvenile organisms. Recovery of invertebrate communities in low-energy environments is more dependent upon larval settlement and recruitment and adult migration. Therefore, rates of recolonization and succession can vary considerably among benthic communities. Recovery of the benthic species would likely require several months to a year or more (Dernie et al. 2003; Lewis et al. 2002). Recovery to a preconstruction state may take 2 to 4 years or more (Van Dalfsen and Essink 2001; Boyd et al. 2005). Fauna in dynamic environments are prone to natural sediment movement and deposition due to strong tidal currents and waves. Therefore, they are able to recover from disturbances more rapidly. Benthic meiofauna are known to recover from sediment disturbances more rapidly than the macrobenthos; recolonization up to pre-disturbance densities has occurred within weeks or less, and entire assemblages have recovered within 90 days (MMS 2009). Within the Offshore Project area, benthic communities are expected to recolonize post-construction activities within months to years following disturbances (SouthCoast Wind 2024). Benthos in coarse sediment and hard-bottom areas of the ECCs are expected to recover slower than the flatter, noncomplex areas in the Lease Area and soft-bottom portions of the ECCs. Therefore, recolonization of benthic organisms in the complex habitat area of the northern Falmouth ECC (beginning in the Muskeget Channel) is expected to occur over a longer period of time. Similarly, the complex glacial moraine habitat within the Rhode Island Sound portion of the Brayton Point ECC will likely be recolonized more slowly than the soft-bottom areas of the northern Brayton Point ECC and Lease Area.

During construction, seabed profile alterations resulting from the Proposed Action could lead to short-term impacts including habitat alteration, injury, and mortality. Under the Proposed Action alone, the impacts on benthic resources from seabed profile alterations, including injury, mortality, and short-term habitat disturbance, would be negligible. Overall impacts of cable emplacement on benthic habitats are anticipated to be negligible to moderate, depending on the location and the method of cable emplacement. Most adverse impacts would be avoided, and adverse impacts that do occur would be temporary or short term in nature.

Non-routine activities that could affect benthic resources include intensive corrective maintenance that would require exposing the cable or foundations for maintenance or require extensive anchoring. This would require the same tools used in installation and would have similar impacts via disturbance to the seafloor (e.g., mortality, sedimentation). However, the disturbance would not exceed that caused by the initial installation, and the affected area should be substantially smaller.

Discharges/intakes: There would be increased potential for discharges from vessels during construction, operations, and decommissioning. Offshore-permitted discharges would include uncontaminated bilge water and treated liquid wastes. There would be an increase in discharges, particularly during construction and decommissioning, and the discharges would be staggered over time and localized. Impacts on benthic resources from vessel discharges, if any, would be localized, short-term, and negligible.

During operation, there would be increased intake and discharge from the HVDC converter OSP(s) in the Lease Area, which requires continuous cooling water withdrawals and subsequent discharge of heated effluent back into receiving waters. SouthCoast Wind developed a NPDES permit application for one offshore HVDC converter OSP in the Lease Area for Project 1 (Appendix B, Figure B-2) (TetraTech and Normandeau Associates, Inc. 2023). If SouthCoast Wind selects HVDC technology for Project 2, the parameters and modeling results from the NPDES permit application for Project 1, described below, would be representative of a HVDC converter OSP for Project 2 located in the southern portion of the Lease Area.

The HVDC converter OSP is expected to withdraw cooling water from the ocean at a rate of approximately 9.9 million gallons per day and maintain an intake velocity of 0.5 feet per second or less. Raw seawater will be withdrawn through up to three intake pipes located 81 feet (24.7 meters) above the seafloor and 74 feet (22.6 meters) below the surface. Seawater intake pipes are fitted with an in-built pump strainer with a typical outer screen size of 0.375 inch (9.5 millimeters) intended to protect the seawater lift pump impeller from debris in the water column. Each OSP pump flowline is also equipped with a dedicated filter (typical mesh size of 250 micrometers), intended to protect the equipment and ensure reliable operation of the CWIS (TetraTech and Normandeau Associates, Inc. 2023).[2]

The potential effects on benthic resources may occur during water withdrawals and would include the entrainment of eggs and larval life stages. In the absence of site-specific plankton densities, SouthCoast

[2] Additional characteristics of the Cooling Water Intake System at the SouthCoast Wind OSP Converter Station are included in the NPDES permit application submitted to the USEPA in October 2022 and revised in August 2023 (TetraTech and Normandeau Associates, Inc. 2023).

Wind, in their NPDES permit application, evaluated an impact assessment for the Northeast Gateway Project where a bioenergetic model was used to address impacts of the removal of zooplankton and small fish. While the model was ultimately used to assess removal of excessive biomass of prey items beyond natural variability and recovery rates, the Northeast Gateway Project was expected to utilize up to 56 million gallons per day and was found to have negligible impacts on the entrainment of zooplankton. Therefore, SouthCoast Wind OSP operations, which will use considerably less cooling water (up to 9.9 million gallons per day), is expected to entrain proportionally lower numbers of zooplankton. SouthCoast Wind further estimated entrainment abundance of ichthyoplankton from cooling water withdrawal at the OSP using EcoMon plankton data from 1977 through 2019. Given the limitations of recent data immediately in the vicinity of the intake location, the minimum, mean, and maximum larval densities observed within 10 miles (16 kilometers) of the OSP location over the full time series were used to extrapolate the range of entrainment abundance assuming a water withdrawal rate of 9.9 million gallons per day. The annual entrainment abundance of fish larvae was estimated to range from 8.3 million to 174.4 million with a mean estimate of 83.2 million. Based on monthly mean larval densities and excluding unidentified fish, the taxa with the highest estimated larval entrainment annually were hakes (*Urophycis* spp.: 3.9 million), Atlantic herring (*Clupea harengus*: 3.9 million), sand lances (*Ammodytes spp.*: 3.3 million), summer flounder (*Paralichthys dentatus*: 1.3 million) and silver hake (*Merluccius bilinearis*: 0.5 million (TetraTech and Normandeau Associates, Inc. 2023).[3]

The potential effects on benthic resources may also arise from thermal impacts due to subsequent heated discharge effluent released back into receiving waters. SouthCoast Wind modeled the thermal plumes of the discharged cooling seawater from the OSP, and results indicated localized increases in water temperature within the vicinity of the discharge location. Based on the modeling results, however, the effluent discharges were found to be minimal. From four modeled maximum temperature delta scenarios in the fall, winter, spring, and summer (TetraTech and Normandeau Associates, Inc. 2023), the distance from the discharge point where the temperature delta reached 1°C (33.8°F) was found to be 41.9 feet (12.8 meters) in the fall, 84.9 feet (25.9 meters) in the winter, 67.5 feet (20.6 meters) in the spring, and 46.6 feet (14.2 meters) in the summer. The effluent plume area was highest in the winter at 792.1 square feet (73.6 square meters) and lowest in the fall at 407.0 square feet (37.8 square meters). These results indicate that impacts to ocean temperature are minimal when the maximum temperature deltas occur and that the water quality standard allowed for by the Ocean Discharge Criteria is expected to be met well within the 330-foot (100-meter) radius mixing zone for initial dilution of discharges (TetraTech and Normandeau Associates, Inc. 2023). Similar impacts would

[3] As further described in the NPDES application (TetraTech and Normandeau Associates, Inc. 2023), due to limitations in the available data, there are uncertainties in these results. For example, entrainment estimates do not fully capture the annual entrainment abundance of all fish and life stages, as all fish eggs and the larvae of less common taxa are excluded from the publicly available EcoMon data set. Additionally, the estimates assume the 1977–2019 time series is representative of the current and future species composition, and that abundance will remain constant each year. The data also represents sampling of ichthyoplankton at various depths, whereas the OSP intake would withdraw water from a discrete depth in the water column (81 feet [24.7 meters] above the seafloor). This may result in overestimation of larval entrainment, as individuals settling in demersal habitats or floating on the surface may not be susceptible to the intake flow.

be anticipated if SouthCoast Wind selects an additional HVDC converter OSP for the southern portion of the Lease Area for Project 2.

While BOEM expects an increase in discharges and intakes during O&M, impacts on benthic resources from the HVDC converter OSP would be long term and minor.

EMFs: During operation, powered transmission cables would produce EMFs (Taormina et al. 2018). To minimize EMFs generated by cables, all cabling under the Proposed Action would include electric shielding (COP Volume 2, Section 16, Table 16-1; SouthCoast Wind 2024). The strength of the EMF increases with electrical current, but rapidly decreases with distance from the cable (Taormina et al. 2018). SouthCoast Wind proposes to bury interarray and export cables to a target depth of 6 feet (1.8 meters). Due to variable conditions in the Lease Area and along the proposed ECC routes, the anticipated burial depth ranges from 3.2 feet (1.0 meter) to 8.2 feet (2.5 meters) for interarray cables and from 3.2 feet (1.0 meter) to 13.1 feet (4.0 meters) for export cables, well below the aerobic sediment layer where most benthic infauna live. Final burial depths would be determined following detailed design. The SouthCoast Wind PDE includes a maximum-case scenario for up to five export cables of 345 kV HVAC in the Falmouth ECC, if Falmouth is selected for Project 2, and up to six export cables 320 kV HVDC in the Brayton Point ECC. Interarray cables will have a nominal voltage of 60–72.5 kV. In some areas, it is possible that cable would be unable to be buried to the target depth and would instead be placed on or near the seafloor with overlying cable protection. Impacts of EMFs are anticipated to be greater where this occurs, as the distance between the cable and biological receptors would be reduced.

The scientific literature provides some evidence of faunal responses to EMFs by marine invertebrates, including crustaceans and mollusks (Hutchison et al. 2018; Taormina et al. 2018; Normandeau et al. 2011), although some reviews (Gill and Desender 2020 and Albert et al. 2020) indicate the relatively low intensity of EMFs associated with marine renewable projects would not result in impacts. Effects of EMFs may include interference with navigation that relies on natural magnetic fields, predator/prey interactions, avoidance or attraction behaviors, and physiological and developmental effects (Taormina et al. 2018). For example, *Cancer* crabs were attracted to EMFs exposed shelters and showed significant reductions in their time spent roaming (Scott et al. 2021). However, this experiment tested response behaviors at EMF values two to three orders of magnitude greater than those detected from offshore wind submarine cables (Normandeau et al. 2011). Studies on the effects of EMFs on marine animals have mostly been restricted to commercially important species (Section 3.6.1, *Commercial Fisheries and For-Hire Recreational Fishing*) and the consequences of anthropogenic EMFs on benthic resources have not been well studied (Gill and Desender 2020; Albert et al. 2020; Snyder et al. 2019). Jakubowska-Lehrmann et al. (2022) examined EMF exposure effects (50 Hz) on the bioenergetics and physiological processes in the cockle (*Cerastoderma glaucum*). Increased protein carbonylation was observed with a significant inhibition of acetylcholinesterase activity indicating neurotoxicity and oxidative damage to the species. Malagoli et al. (2004) exposed the mussel (*Mytilus galloprovincialis*) to EMFs (50 Hz) and observed the expression of heat shock proteins indicating a cellular stress response.

While considered a localized phenomenon, electricity produced during operation may increase temperatures within the direct vicinity of interarray and export cables, specifically, the surrounding sediment and water where benthic resources reside (Riefolo et al. 2016; Tabassum-Abbasi et al. 2014). Thermal impacts are expected to result in a slight increase in temperature a few centimeters from cables and benthic resources within the general vicinity may experience negative effects from the increased temperature (Tabassum-Abbasi et al. 2014). Chemical and physical properties of the substratum may also be affected by increased temperature resulting in spatial changes in benthic community structure, physiological changes to benthic organisms, and an alteration of the oxygen concentration profile, which could then indirectly impact the development of microorganisms (Taormina et al. 2018). The heat emitted by HVAC cables would be higher than that of HVDC cables at an equal transmission rate (Taormina et al. 2018). Further studies need to be completed to accurately assess long-term impacts of EMFs on the surrounding ecosystem as in-situ investigations are lacking.

CSA Ocean Sciences, Inc. and Exponent (2019) found that offshore wind energy development as currently proposed would have minor effects, if any, on benthic resources. Although demersal biota are the most likely to be exposed to the EMFs from power cables, potential exposure would be minimized because an EMF quickly decays with distance from the cable source (CSA Ocean Sciences, Inc. and Exponent 2019). Project-specific modeling confirmed that EMFs diminished rapidly with distance (COP Appendix P1; SouthCoast Wind 2024). In the case of mobile species, an individual exposed to EMFs would cease to be affected when it leaves the affected area. An individual may be affected more than once during long-distance movements; however, there is no information on whether previous exposure to EMFs would influence the impacts of future exposure. Therefore, BOEM expects effects from EMFs due to the Proposed Action to have long-term, localized, and minor impacts on benthic resources.

Gear utilization: SouthCoast Wind's fisheries and benthic monitoring plans (SMAST 2024; INSPIRE 2023a; INSPIRE 2024) propose a variety of survey methods to evaluate the effects of construction and operations on benthic habitat structure and composition and economically valuable fish and invertebrate species. The survey methods are explained in detail in Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*, which includes a discussion on the effects of gear utilization on prey species. The proposed survey methods include acoustic telemetry, drop camera, demersal trawl, ventless trap/pot, Neuston net sampling, video/photography surveys, sediment grab sampling, and SPI/PV. In addition to specific requirements for monitoring during the construction period, periodic PAM deployments may occur over the life of the Project for other scientific monitoring needs. All requirements of the Proposed Action will follow BOEM's 2021 Project Design Criteria and Best Management Practices (BOEM 2021c) to limit interactions with protected species.

Impacts from gear utilization related to benthic and fisheries monitoring surveys performed in support of the Proposed Action would likely range from negligible to minor. Impacts from the surveys are expected to be localized, and soft-bottom habitats would be expected to recover fairly quickly from the disturbance in the short term; however, disturbance to hard-bottom habitat would take longer to recover from. The time period for recovery would depend on the mobility and life stage of each species, with sessile organisms less able to avoid impacts and mobile organisms more able to avoid impacts.

Noise: The Proposed Action would result in noise from G&G surveys, WTG O&M, pile driving, and cable burial or trenching. The natures of these sub-IPFs and of their impacts on benthic resources are expected to be similar to that described under the No Action Alternative for other wind farm projects and have been previously described in Section 3.5.2.3, *Impacts of Alternative A – No Action on Benthic Resources*.

The most substantial noise produced from the Proposed Action would be from pile driving during installation of up to 149 foundations. Given that most benthic species in the region are either mobile as adults or planktonic as larvae, disturbed areas (either through injury or mortality) would likely be recolonized naturally. Other sources of noise, including G&G surveys, WTG operation, and cable trenching, would be of lower magnitude and, therefore, less impactful, even if they occur over larger geographic areas. If injury or mortality occurred to benthic organisms, the affected areas would likely be recolonized in the short-term, and no population-level impacts would be expected. Impacts would therefore be localized and short-term, and may be negligible to minor, depending on the duration of activities.

Port utilization: The Proposed Action would not directly result in any port-expansion or construction activities and would therefore not have direct impacts on benthic resources from these activities. Likewise, any port improvements are not dependent on the Proposed Action being analyzed in this EIS. However, multiple projects are proposed to increase port capacity that may support the Proposed Action. Impacts on benthic resources from port construction or upgrades would be local to those ports and would support not just the Proposed Action but other offshore wind projects and general maritime activity as well. Any increase in port utilization would be highest during construction, minor during operation, and moderate during decommissioning. Impacts on benthic resources would be localized and minor.

Presence of structures: Under the Proposed Action, the presence of structures could result in various impacts as described in Section 3.5.2.3. The Proposed Action would install up to 147 WTG foundations, resulting in up to 660.3 acres (271.3 hectares) of temporary and permanent seabed disturbance (combined area of foundation and scour protection), assuming suction bucket jacket foundations (largest of the proposed foundation types) are used for up to 85 WTG positions with the remaining WTG positions using piled jacket foundations. The total permanent footprint for two additional piled jacket foundations for OSPs (combined area of foundation and scour protection) could result in up to 19.6 acres (7.4 hectares) of permanent seabed disturbance.

The presence of structures would increase the risk of gear loss or damage by entanglement. The lost gear, moved by currents, can disturb, injure, or kill benthic resources. The impacts at any one location would likely be localized and short to long-term, although the risk of occurrence would persist if the structures and debris remain. Overall, this is anticipated to have a minor impact on benthic resources.

Once construction is complete, the presence of the WTG and OSP foundations could result in some alteration of local water currents, which could produce sediment scouring and alter benthic habitat. Local changes in scour and sediment transport close to a foundation may alter sediment grain sizes and benthic community structure (Lefaible et al. 2019), though this impact is expected to be minimal due to the use of scour protection for each foundation. These effects, if present, would exist for the duration of the Proposed Action and would be reversed only after the Project has been decommissioned, although they may be permanent if scour protection is left in place.

Results from recent hydrodynamic modeling studies specific to U.S. offshore wind developments in the Southern New England region and the effects of wind farm structures on larval transport and dispersal (Chen et al. 2021; Johnson et al. 2021) found that WTGs alter vertical mixing, horizontal advection, and horizontal turbulent dispersion (Chen et al. 2021) and that the introduction of the offshore wind structures into the offshore WEA modifies the oceanic responses of current magnitude, temperature, and wave heights by (1) reducing the current magnitude through added flow resistance, (2) influencing the temperature stratification by introducing additional mixing, and (3) reducing current magnitude and wave height by extracting energy from the wind (Johnson et al. 2021). Both studies found discernable changes in larval dispersion and settlement for their target species (Chen et al. 2021: Atlantic sea scallop; Johnson et al. 2021: Atlantic sea scallop, silver hake, summer flounder) resulting from the hydrodynamic effects of wind turbine structures. However, these localized impacts were not considered to be biologically significant at population levels for species like hake and scallops that spawn over broad areas across the Southern New England region (Johnson et al. 2021). As model results from Chen et al. (2021) and Johnson et al. (2021) are limited by their temporal, spatial, or species-specific input parameters, future modeling studies should focus on assessing impacts over multiple years and spawning seasons to reveal long-term structural shifts in larval settlement patterns, analyzing additional species and life stages, and evaluating impacts from multiple offshore wind development scenarios and locations (Hogan et al. 2023).

Vertical structures in the water column would also create turbulence that can transport nutrients upward toward the surface. The introduction of nutrients from deep waters into the surface mixed layer can lead to a local increase in primary production (Floeter et al. 2017). These changes have been reported to increase food availability for filter feeders such as blue mussels (Slavik et al. 2019) on and near the structures, which, in turn, leads to increased densities of mobile invertebrates (e.g., crabs, lobsters), attraction and diet modification of pelagic and demersal fish, and foraging opportunities for marine mammals (Coates et al. 2014; Dannheim et al. 2020; English et al. 2017).

The presence of structures would also result in new hard surfaces that could provide new habitat for recruitment of hard-bottom species and structure-oriented communities (Daigle 2011). The addition of new substrate could provide steppingstones for invasive species colonization (Coolen et al. 2020). Nonnative benthic invertebrates found within the vicinity of the Project area include but are not limited to *Ascidiella aspersa*, *Botrylloides violaceus*, *Diplosoma listerianum*, *Styela clava, Botryllus schlosseri, Bugula neritina, Tricellaria inopinata, Membranipora membranacea, Ostrea edulis,* and *Diadumene lineata* (Agius 2007; Mass.gov 2022). The invasive tunicate *Didemnum vexillum* (*D. vexillum*) has additionally been expanding its presence in New England waters and was identified within the Project area (COP, Appendix M.2; SouthCoast Wind 2024). Benthic monitoring at the Block Island Wind Farm has shown that this species is part of a diverse faunal community on morainal deposits and is an early colonizer along the edges of anchor scars left in mixed sandy gravel with cobbles and boulders

(Guarinello and Carey 2020). Four years after construction at the Block Island Wind Farm*, D. vexillum* was common on WTG structures (HDR 2020). Studies have shown that activities that cause fragmentation of *D. vexillum* colonies can facilitate its distribution (Lengyel et al. 2009; Morris and Carman 2012). Turbine and cable installation within hard-bottom habitat where *D. vexillum* is present could fragment the invasive colonies (Morris and Carman 2012). The addition of new artificial substrate used for cable and scour protection and the presence of WTG structures may provide habitat for this invasive tunicate.

Soft bottom is the dominant habitat type in the region, and species that rely on this habitat would not likely experience population-level impacts (Guida et al. 2017; Greene et al. 2010). Studies have found increased diversity and biomass for benthic fish and invertebrates around foundation structures in the offshore environment (Lefaible et al. 2019; Raoux et al. 2017; Pezy et al. 2018). In addition to providing new habitat for hard-substrate organisms, Tong et al. (2022) showed that novel artificial substrate like WTG foundations provide excellent bacterial colonization and that these new structures display higher bacterial diversity than 10-year-old structures and control sites. This indicates that offshore wind farms can generate some beneficial impacts on local ecosystems. Studies show that 95 percent of biomass on artificial structures is composed of suspension-feeding species, many of which are resource flexible (Coolen et al. 2020; Mavraki et al. 2020a). This abundance of suspension feeders can cause a “biofilter” effect and decrease overall turbidity and increase light penetration (Reichart et al. 2017; Mavraki et al. 2020b). These communities are also known to contribute larger deposition of fecal pellets (Maar et al. 2009), which ultimately decreases sediment pore size and increases humic acid and sulfide concentrations from increased bacterial decomposition, which can affect sediment pH (Tong et al. 2022). However, some impacts such as the loss of soft-bottom habitat may be adverse depending on the resource affected. Similar effects would be expected from the use of scour protection and concrete mattresses for cable protection at cable-crossing locations. SouthCoast Wind anticipates a maximum of 16 cable-crossing locations along the Brayton Point ECC potentially requiring up to nine concrete mattresses each. Interarray cable crossings may also require cable protection; however, cable-crossing locations along the interarray cable layout have not yet been identified. Colonization of concrete mattresses used for cable protection by epifouling taxa, mobile invertebrates, and benthic fishes has been found to occur in European wind farms. A recent study on artificial hard-substrate colonization at the Hywind Scotland Pilot Park floating offshore wind farm (Karlsson et al. 2022) found species of hydroids, sea stars, crab, lobster, flatfish, and ling inhabiting concrete mattresses used for cable protection 3 years post-construction. It is expected that epifaunal colonization, species succession, and reef effects would also occur on concrete mattresses used within the SouthCoast Wind Project area; however, the magnitude of effects may vary by location and season. BOEM anticipates that the impacts associated with the presence of structures would be long-term and minor to moderate beneficial. The impacts on benthic resources resulting from the presence of structures would persist as long as the structures remain.

Impacts of Alternative B on ESA-Listed Species

No benthic species in the region are ESA-Listed; therefore, no impacts are expected.

Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned non-offshore wind and offshore wind activities. Ongoing and planned non-offshore wind activities that affect benthic resources in the geographic analysis area include dredging, coastal development, offshore construction, submarine cables and pipelines, oil and gas activities, marine minerals extraction, port expansions, and climate change.

The cumulative impacts of accidental releases from ongoing and planned activities on benthic resources would likely range from negligible, localized, and short term (for fuels, hazardous materials, trash/debris) to moderate, possibly widespread, and long term (for invasive species). BOEM assumes all vessels would comply with laws and regulations to properly dispose of marine debris and minimize releases of fuels/fluids/hazardous materials. Additionally, large-scale releases are unlikely and impacts from small-scale releases would be localized and short term, resulting in little change to benthic resources. Most of the risk of accidental releases of invasive species comes from ongoing activities, and the impacts (mortality, decreased fitness, disease) due to other types of accidental releases are expected to be negligible and short-term.

Anchoring impacts from ongoing and planned activities would be localized, short term, and minor due to the relatively small size of the affected areas compared to the remaining area of the open ocean within the geographic analysis area and short-term nature of the impacts. Additionally, Project-related anchoring activity would be limited, as the construction/decommissioning phases would occur over a relatively short window.

There would be increased potential for discharges from vessels during construction, operations, and decommissioning activities related to the Proposed Action and other offshore wind projects; however, it is expected that these discharges would be staggered over time and localized. Many discharges are required to comply with permitting standards established to ensure potential impacts on the environment are minimized or mitigated. Cumulative impacts of discharges resulting from ongoing and planned activities would be short term, local, and minor.

Export and interarray cables from the Proposed Action and other offshore wind development would add an estimated 3,961 miles (6,375 kilometers) of buried cable to the geographic analysis area, of which the Proposed Action represents 42 percent, producing EMF in the immediate vicinity of each cable during operation. EMF effects from these projects on benthic habitats could be behavioral or physiological and would vary in extent and significance depending on overall cable length, the proportion of buried versus exposed cable segments, and project-specific transmission design (e.g., HVAC or HVDC, transmission voltage). BOEM would require planned submarine power cables to have appropriate shielding and burial depth to minimize potential EMF effects from cable operation. Cumulative impacts of EMFs from ongoing and planned activities in the geographic analysis area would likely be minor and localized based on current research; however, more research is needed to better understand the effects of EMFs on benthic organisms.

Cable emplacement of export and interarray cables would result in mostly short-term impacts from disturbance, injury, and mortality of benthic resources during installation activities. In most locations, the affected areas are expected to recover naturally; for example, seabed scars associated with jet plow cable installation are expected to recover in a matter of weeks, allowing for rapid recolonization (MMS 2009). The Proposed Action in combination with the other offshore wind development within the geographic analysis area is estimated to result in 10,328 acres (4,179 hectares) of seabed disturbance from cable emplacement in the geographic analysis area, of which the Proposed Action represents 38 percent. Simultaneous construction of export and interarray cables from nearby offshore wind projects would have an additive effect, although it is assumed that only a portion of a project's cable system would be undergoing installation or maintenance at any given time. Substantial areas of open ocean are likely to separate simultaneous offshore export and interarray cable installation activities for other offshore wind projects. BOEM expects that the cumulative impacts of cable emplacement and maintenance on benthic resources would be minor to moderate.

Other offshore wind activities would generate comparable types of noise impacts to those of the Proposed Action. The most significant sources of noise are expected to be pile driving. The Proposed Action would contribute 149 structures, or 20 percent, of the total 747 foundations that would be installed within the geographic analysis area. If multiple piles are driven simultaneously and within close proximity to one another, the areas of potential injury or mortality may overlap but that is anticipated to be unlikely and, as described for the Proposed Action, benthic organisms are anticipated to recover quickly. Cumulative noise impacts of the Proposed Action in combination with ongoing and planned activities would be localized, short term, and minor.

Cumulative impacts of port utilization associated with offshore wind-related activities would primarily result in water quality and vessel noise impacts but could also result in habitat alteration associated with port-expansion activity. The Proposed Action would not contribute to port expansion and would have no appreciable change in port utilization. In context of reasonably foreseeable environmental trends, the cumulative impacts on benthic resources from port utilization would be minor.

The Proposed Action, in combination with the other offshore wind activity, would add up to 747 foundations in the geographic analysis area. The presence of these structures could affect local hydrodynamics, increase the risk of gear entanglement and loss, convert soft-bottom habitat to hard-bottom habitat, and increase the risk of establishment of invasive species. Cumulative impacts on benthic resources from presence of structures would be long term and moderate adverse to moderate beneficial.

Conclusions

Impacts of the Proposed Action: Activities associated with the construction and installation, O&M, and conceptual decommissioning in the Wind Farm Area and ECCs would affect benthic resources by causing temporary habitat disturbance; permanent habitat conversion; and behavioral changes, injury, and mortality of benthic fauna. BOEM anticipates the impacts resulting from the Proposed Action would range from negligible to moderate, including the presence of structures, which may result in moderate beneficial impacts. The most prominent IPFs are expected to be new cable emplacement, noise from pile driving, anchoring (particularly where it may affect SAV), and the presence of structures. In general, the impacts are likely to be local and are not likely to alter the overall character of benthic resources in the geographic analysis area. The Proposed Action would result in overall **moderate adverse** impacts on benthic resources, despite benthic resource mortality and short-term or permanent habitat alteration, the resources would likely recover naturally over time. The Proposed Action would also result in **moderate beneficial** impacts associated with the presence of structures and associated addition of structurally complex hard-bottom habitat.

Cumulative Impacts of the Proposed Action: Cumulative impacts from the Proposed Action when combined with impacts from ongoing and planned activities including offshore wind would be moderate adverse and moderate beneficial for benthic resources in the geographic analysis area. The main drivers for this impact rating are bottom disturbance including the emplacement of cables/structures and the long-term presence of structures and scour/cable protection. The Proposed Action would contribute to the cumulative impact rating primarily through temporary impacts due to new cable emplacement and permanent impacts from the presence of structures (i.e., cable protection measures and foundations). BOEM has considered the possibility of a significant impact resulting from invasive species and considers it unlikely; this level of impact could occur if an invasive species were to adversely affect benthic ecosystem health or habitat quality at a regional scale. While it is an impact that should be considered, it is also unlikely to occur, and the incremental increase in this risk due to the Proposed Action is negligible. Although some of the proposed activities and IPFs analyzed could overlap, BOEM does not anticipate that this would alter the overall impact rating. Considering all IPFs together, BOEM anticipates the cumulative impacts on benthic resources from ongoing and planned activities, including the Proposed Action, would be **moderate adverse**, with some **moderate beneficial** impacts because they would not result in population-level effects.

3.5.2.6 Impacts of Alternative C on Benthic Resources

Impacts of Alternative C: Under Alternative C, the Brayton Point offshore export cable would be routed onshore (through Aquidneck Island, Rhode Island under and through Little Compton/Tiverton, Rhode Island under Alternative C-2) to avoid fisheries impacts in the Sakonnet River. Alternative C-1 would make landfall at Sachuest Beach on Aquidneck Island and reduce the offshore portion of the Brayton Point ECC by 9 miles (14 kilometers). This 10 percent decrease in offshore cable length would result in approximately 52 fewer acres (21 hectares) of seabed disturbance compared to the Proposed Action (Table 3.5.2-2). Alternative C-2 would reduce the offshore portion of the Brayton Point ECC by approximately 12 miles (19 kilometers). This 12.7 percent decrease in offshore cable mileage would result in 70 fewer acres (28 hectares) of seabed and benthic habitat disturbance compared to the Proposed Action (Table 3.5.2-2).

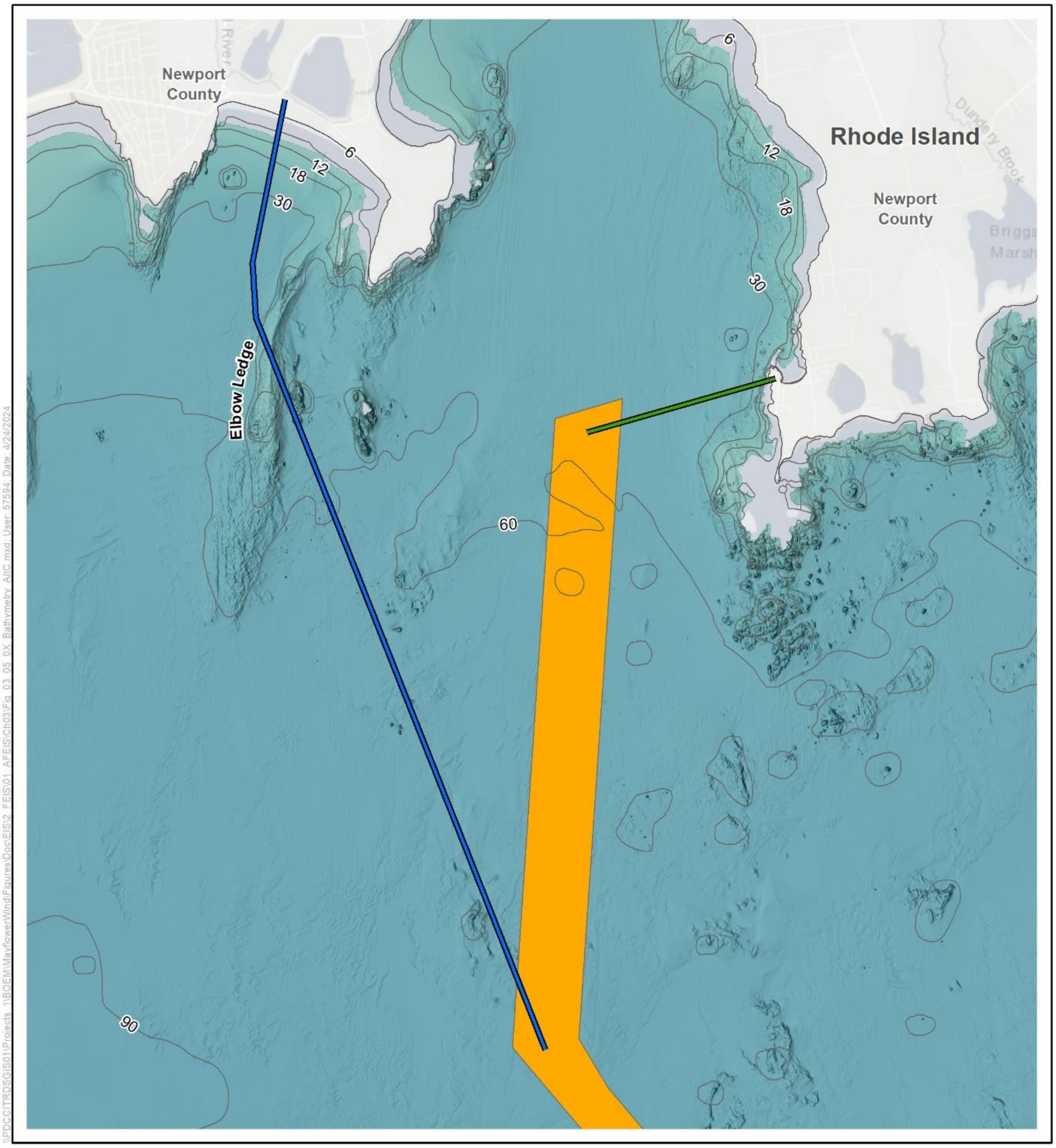
The Sakonnet River contains a mix of soft-bottom and complex substrates, which can be important benthic habitats for fish and invertebrates. In a few locations, live *Crepidula* reefs or *Crepidula* shell hash were found on the sediment surface overlying reduced silt (COP Appendix M.2; SouthCoast Wind 2024), which is a biogenic habitat that also adds complexity to the seafloor. Of the Brayton Point ECC within

Rhode Island state waters, of which the majority is within the Sakonnet River and Mount Hope Bay, 62 percent of benthic sediments are sand or finer. *Crepidula* substrate was also mapped exclusively within the Sakonnet River and Mount Hope Bay across 1,305 acres (528 hectares) or 22 percent of all Rhode Island state waters. This complex habitat along with some boulder fields in Mount Hope Bay are EFH for many species, and Alternatives C-1 and C-2 would reduce impacts on benthic resources by reducing the length of offshore cable and there would be fewer impacted acres. Because the cables would be routed onshore (Chapter 2, Figure 2-6), Alternative C would completely avoid impacts on these habitats in the Sakonnet River. The area of estuarine benthic disturbance would also decrease under both Alternative C-1 and Alternative C-2. However, the long-term effects of avoiding construction through these habitats is difficult to quantify. Impacts associated with cable emplacement in complex or sensitive habitats such as areas with *Crepidula* reefs, cobbles, or boulders, may impose long-term or permanent impacts where these habitats are present within the cable route.

While Alternative C would reduce the total area of benthic habitat disturbance, cable emplacement activity would still occur along the rest of the offshore export cable and result in localized sediment suspension and habitat disturbance. The portions of Alternative C-1 and Alternative C-2 cable corridors that occur outside of the Proposed Action's cable corridor (approximately 6 miles [9.7 kilometers] under Alternative C-1 and 4 miles [6.4 kilometers] under Alternative C-2) have not been surveyed for the Project, and, therefore, the specific benthic resources that would be affected are not fully known at this time. However, to support BOEM's analysis of the alternatives, SouthCoast Wind commissioned a geohazard desktop study that evaluated geological features and other constraints associated with both Alternative C-1 and Alternative C-2 (TetraTech 2023) and a desktop benthic study using available site-specific and regional benthic data for Alternative C-1 (INSPIRE 2023b). No SAV beds were found proximate to the Alternative C-1 landfall site. Within the 6-mile portion of the Alternative C-1 route toward the Aquidneck Island landfall, all of the over 20 USGS benthic grab samples consisted of Muddy Sand and Sand, except for one Gravel sample near the landfall location at Sachuest Beach (INSPIRE 2023b). However, the Alternative C-1 route would pass through Elbow Ledge, a high relief bathymetric feature with complex habitat composed of sand and gravel to the south of Sachuest Bay (Figure 3.5.2-2) that likely provides hard substrate for attached fauna to grow and supports benthic and demersal species (INSPIRE 2023b). Installing export cable across this shoal would adversely impact this complex habitat and benthic organisms. Impacts on this complex benthic feature under Alternative C-1 and Alternative C-2 could result in greater impacts than the Proposed Action.

Overall, it is anticipated that the impacts resulting from individual IPFs associated with construction and installation, O&M, and decommissioning of the Project under Alternative C would be similar to those described under the Proposed Action.

Cumulative Impacts of Alternative C: In the context of reasonably foreseeable environmental trends, cumulative impacts of Alternative C would be similar to those described under the Proposed Action.



Alternative C-1 Offshore Export Cable Route
Alternative C-2 Offshore Export Cable Route
Brayton Point Offshore Export Cable Corridor

Source: BOEM 2022, EPA 2022, MAEEA 2022.

N 0 1 2 Miles
1:60,000

Figure 3.5.2-2. Alternatives C-1 and C-2 bathymetry

Impacts of Alternative C on ESA-Listed Species

No benthic species within the region are ESA-Listed; therefore, no impacts are expected.

Conclusions

Impacts of Alternative C: Alternative C-1 and Alternative C-2 would result in a 10 to 12.7 percent reduction in the length of the Brayton Point offshore ECC and fewer acres of disturbed seabed, respectively. However, the construction and installation, O&M, and decommissioning of Alternative C would still result in similar overall impacts as the Proposed Action. Alternative C would result in **moderate adverse** impacts and could include potentially **moderate beneficial** impacts.

Cumulative Impacts of Alternative C: In the context of reasonably foreseeable environmental trends, BOEM anticipates that the cumulative impacts associated with Alternative C would be similar to the Proposed Action, and result in **moderate adverse** and **moderate beneficial** impacts on benthic resources in the geographic analysis area because they would not result in population-level effects. Although a measurable impact is anticipated, benthic resources would likely recover completely following decommissioning.

3.5.2.7 Impacts of Alternative D (Preferred Alternative) on Benthic Resources

Impacts of Alternative D: Alternative D would eliminate six WTGs in the northeastern portion of the Lease Area to reduce impacts on foraging habitat along the western edge of Nantucket Shoals. Nantucket Shoals is relatively shallow (less than 164 feet [50 meters]) and an area of high biological productivity (Townsend et al. 2006). This broad area extends south, southeast, and east of Nantucket and contains complex, dunelike topography, which reflects the strong tidal currents (PCCS 2005). This would lead to a reduction of 15.1 acres (6.1 hectares) of total foundation footprint contacting the seabed (combined area of foundation and scour protection) compared to the Proposed Action, assuming monopile foundations. The amount of seabed disturbance from interarray cable installation would also be reduced, with less benthic surface level cable crossings. A roughly 4 percent reduction in WTGs under Alternative D would result in approximately 20 miles (32 kilometers) less interarray cable length in the Lease Area. The removal of up to six WTGs would proportionally reduce the interarray cable footprint of impact by an estimated 56.7 acres (22.9 hectares) from the total 1,408 acres (570 hectares) of impact from the Proposed Action. This would reduce total long-term benthic habitat impacts (Table 3.5.2-2), but the impact magnitude would be the same as the Proposed Action.

Cumulative Impacts of Alternative D: In the context of reasonably foreseeable environmental trends, cumulative impacts of Alternative D would be similar to those described under the Proposed Action, although with a slightly reduced footprint.

Impacts of Alternative D on ESA-Listed Species

No benthic species in the region are ESA-Listed; therefore, no impacts are expected.

Conclusions

Impacts of Alternative D: Impacts of Alternative D would be reduced compared to impacts of the Proposed Action because of reductions in noise impacts and total seabed and benthic habitat disturbance. Construction and installation, O&M, and decommissioning of Alternative D would result in the same **moderate adverse** impacts as the Proposed Action and could include potentially **moderate beneficial** impacts.

Cumulative Impacts of Alternative D: In the context of reasonably foreseeable environmental trends, BOEM anticipates that the cumulative impacts associated with Alternative D would be similar to the Proposed Action and result in **moderate adverse** and **moderate beneficial** impacts on benthic resources in the geographic analysis area. Although a measurable impact is anticipated, benthic resources would likely recover completely following decommissioning.

3.5.2.8 Impacts of Alternative E on Benthic Resources

Impacts of Alternative E: Alternative E includes the use of all piled (Alternative E-1), all suction bucket (Alternative E-2), or all GBS (Alternative E-3) foundations for WTGs and OSPs. Installation activities would not differ between the Proposed Action and Alternative E-1, which assumes pile driving would be used for all foundations with corresponding noise impacts. Under Alternative E-2 and Alternative E-3, no pile driving would occur; therefore, there would be no underwater noise impacts on benthic resources due to pile driving. The avoidance of pile-driving noise impacts would reduce overall construction and installation impacts on benthic resources under Alternative E-2 and Alternative E-3 compared to the Proposed Action.

Of the 149 total foundations, benthic habitat impacts were calculated based on 147 WTGs and two OSPs (Table 3.5.2-2). Under Alternative E-1, 403.3 acres (163.2 hectares) of benthic habitat would be disturbed from 2.6 acres (1.1 hectares) per WTG and 9.8 acres (3.9 hectares) per OSP using piled foundations. Under Alternative E-2, 730.1 acres (295.5 hectares) of benthic habitat would be disturbed from 4.9 acres (2.0 hectares) per WTG and 4.9 acres (2.0 hectares) per OSP using suction bucket foundations. Under Alternative E-3, 1,719.7 acres (695.9 hectares) of benthic habitat would be disturbed from 11.6 acres (4.7 hectares) per WTG and 10.9 acres (4.4 hectares) per OSP using GBS. The maximum total dredging volume of all foundations combined for GBS installation would be 111,973,203 cubic feet (3,170,728 cubic meters).

GBS foundations would lead to the greatest area of habitat conversion from soft sediments to hard vertical structure due to foundation footprint and scour protection. Alternative E-1 would result in a 77 percent reduction in footprint and scour protection, and Alternative E-2 would result in a 58 percent reduction in footprint and scour protection, compared to Alternative E-3. GBS foundations could also increase the risk of spreading invasive species from the increased surface area and scour protection. SouthCoast Wind may use GBS made of concrete, which may be more porous and susceptible to being colonized by marine organisms than piled and suction bucket foundations made of steel (BOEM 2021b). GBS and suction bucket foundations may be built in water within ports and then towed to the Wind

Farm Area (BOEM 2021b), which presents an increased risk of invasive species spread by transporting marine organisms from port locations to the Lease Area. All alternative foundation types compared to monopile foundations would lead to larger artificial reef effects, where the increased surface area would benefit some benthic species. The increase in structure would also cause more aggregation of fish predator species, which may alter benthic invertebrate species composition. Less than 1 percent of soft-bottom habitat loss in the Lease Area is expected from foundation and scour protection installation; therefore, impact levels are not expected to change under this alternative. Given that Alternative E would result in reductions in both adverse and beneficial impacts, impacts on benthic resources under the alternative are not expected to be measurably different from those anticipated under the Proposed Action.

Cumulative Impacts of Alternative E: In the context of reasonably foreseeable environmental trends, the cumulative impacts of Alternative E would be similar to those described under the Proposed Action.

Impacts of Alternative E on ESA-Listed Species

No benthic species within the region are ESA-Listed; therefore, no impacts are expected.

Conclusions

Impacts of Alternative E: The impacts of Alternative E-1 would be the same as the Proposed Action. Construction and installation, O&M, and decommissioning of Alternative E-1 would likewise result in **moderate adverse** impacts and could include potentially **moderate beneficial** impacts.

Impacts of Alternative E-2 and Alternative E-3 would be similar to impacts of the Proposed Action with the most notable difference being the avoidance of pile-driving noise impacts and the increased foundation footprints. Construction and installation, O&M, and decommissioning of Alternative E-2 and Alternative E-3 would result in **moderate adverse** impacts and could include potentially **moderate beneficial** impacts.

Cumulative Impacts of Alternative E: In the context of reasonably foreseeable environmental trends, BOEM anticipates that the cumulative impacts of Alternative E would be the same as the Proposed Action, resulting in **moderate adverse** and **moderate beneficial** impacts on benthic resources in the geographic analysis area. Although a measurable impact is anticipated, benthic resources would likely recover completely following decommissioning.

3.5.2.9 Impacts of Alternative F on Benthic Resources

Impacts of Alternative F: Under Alternative F, the Falmouth offshore export cable route would include the use of up to three ±525kV HVDC cables connected to one HVDC converter OSP, instead of up to five HVAC cables connected to one or more HVAC OSPs as proposed under the Proposed Action, to minimize seabed disturbance to complex habitats in the Muskeget Channel. The additional HVDC converter OSP associated with Falmouth would be located in deeper waters in the southern portion of the Lease Area at a further distance from Nantucket Shoals. Potential effects on benthic resources may occur during water withdrawals by the CWIS, which may lead to the entrainment of eggs and larval life stages of benthic organisms and thermal impacts during the subsequent discharge of heated effluent. BOEM anticipates the same types of impacts on benthic resources as the Proposed Action (which also includes the potential for multiple HVDC OSPs).

In modeling the effects of entrainment on larval dispersal patterns and population dynamics associated with once-through CWISs in power plants in the coastal region of California, White et al. (2010) found that the effects of CWIS entrainment were highly localized in space and had minimal effects on population densities of benthic organisms except when the population had been heavily depleted by other factors. Entrainment effects were also found to be more severe when the CWIS intake was located nearshore as opposed to farther offshore due to the low rates of diffusive movement nearshore. Mitigation measures in the operation of the converter OSP CWIS, such as restricting intake velocities to less than 0.5 feet per second, single pump operation, and dual pump operation at reduced capacity via three-way valve or variable frequency drives have been put in place to minimize potential entrainment impacts (TetraTech and Normandeau Associates, Inc. 2023). With these measures in place, impacts would be minimized, and it is not expected that Alternative F would result in a change in impacts from an additional HVDC converter OSP compared to the Proposed Action (the Proposed Action includes the potential for multiple HVDC converter OSPs).

Under Alternative F, the Falmouth offshore export cable route would include only three HVDC cables compared to up to five HVAC cables under the Proposed Action, which would reduce the total seafloor and benthic habitat disturbance by approximately 700 acres (284 hectares) (Table 3.5.2-2). In comparison, a total of 1,753 acres (709 hectares) would be disturbed by the Falmouth export cables under the Proposed Action. Impacts from cable emplacement and anchoring may be reduced under Alternative F due to fewer cables installed. The cables would be sited in the same corridor as the Proposed Action so it is likely that the same benthic communities would be affected by cable emplacement, but the total area extent of impacts would be less. See Section 3.5.2.1, *Description of the Affected Environment,* for a description of benthic resources that would be affected by cable emplacement under the Proposed Action. Approximately 2,140 acres of complex habitat (coarse sediment, glacial moraine A, and boulder fields) can be found within an 8.2-mile (13.2-kilometer) segment of the Falmouth ECC as it crosses the Muskeget Channel (INSPIRE 2022). The total width of disturbance of the cables would be reduced from 98.5 feet (assuming a 19.7-foot-wide disturbance per cable; COP Volume 1, Table 3-29; SouthCoast Wind 2024) under the Proposed Action to 59.1 feet under Alternative F, reducing the extent of impacts on habitats along this segment of the Falmouth cable corridor from 98 acres to 59 acres. Depending on the final cable placement in the ECC, up to a 40 percent reduction in seabed disturbance from installation of the Falmouth offshore export cables can be anticipated which would reduce impacts on benthic habitats, in particular complex habitats found in the Muskeget Channel and associated benthic resources.

Though fewer DC cables would be installed under Alternative F, the amplitude of EMF generated by DC cables can be up to three times greater than that of AC cables (Hutchison et al. 2020). However, AC and DC EMFs differ in the way they interact with organisms and direct comparisons cannot be made (CSA Ocean Sciences, Inc. and Exponent 2019). Previous studies on DC undersea cables have shown only temporary alterations in mobility and behavior of some fish and invertebrate species with no appreciable effects on overall movement or population health (Hutchison et al. 2018; Wyman et al. 2018; Klimley et al. 2017). Furthermore, the effects of EMFs from undersea cables are substantially reduced when the target cable burial depth of 3.2 to 13.1 feet (1.0 to 4.0 meters) is achieved (CSA Ocean Sciences, Inc. and Exponent 2019). Even with the reduction in cables, the same temporary construction impacts and long-term operational impacts from cable installation would still occur and there would be no change in impacts from other offshore components (e.g., WTGs) under this alternative. As with the Proposed Action, benthic resources would be expected to recover naturally over time. The additional HVDC converter OSP would result in increased impacts from the CWISs and heated effluent, but impacts would remain localized and minor; thus, BOEM expects that there would be no change in the overall impact magnitude to benthic resources under Alternative F.

Cumulative Impacts of Alternative F: In the context of reasonably foreseeable environmental trends, cumulative impacts of Alternative F would be similar to those described under the Proposed Action.

Impacts of Alternative F on ESA-Listed Species

No benthic species within the region are ESA-Listed; therefore, no impacts are expected.

Conclusions

Impacts of Alternative F: By reducing the number of Falmouth offshore export cables, Alternative F would reduce impacts on benthic resources compared to the Proposed Action, but the overall impact level would remain the same. Construction and installation, O&M, and decommissioning of Alternative F would likewise result in **moderate adverse** impacts on benthic resources and could include potentially **moderate beneficial** impacts.

Cumulative Impacts of Alternative F: In the context of reasonably foreseeable environmental trends, BOEM anticipates that the cumulative impacts of Alternative F would be similar to the Proposed Action and result in **moderate adverse** and **moderate beneficial** impacts on benthic resources in the geographic analysis area. Although a measurable impact is anticipated, benthic resources would likely recover completely following decommissioning.

3.5.2.10 Comparison of Alternatives

The impacts resulting from the Proposed Action would range from negligible to moderate, including the presence of structures, which may result in moderate beneficial impacts. Despite benthic mortality and temporary or permanent habitat alteration, BOEM expects the long-term impact on benthic communities from construction and installation of the Proposed Action to be minor, as the resources would likely recover naturally over time. Alternatives C-1 and C-2 would result in a 10–12.7 percent reduction in the length of the Brayton Point offshore ECC and fewer acres of disturbed seabed, respectively, but the impacts would be similar to those of the Proposed Action. Impacts of Alternative D would be reduced compared to impacts of the Proposed Action because of reductions in noise impacts and total seabed and benthic habitat disturbance. However, construction and installation, O&M, and decommissioning would result in the same impacts as the Proposed Action. Impacts of Alternative E-1 would be the same as the Proposed Action, while Alternative E-2 and Alternative E-3 would result in increased benthic habitat disturbance from use of larger foundation footprints. Under Alternative F, by reducing the number of Falmouth offshore export cables, impacts would be reduced on benthic resources compared to the Proposed Action, but the overall impact would be the same. The difference in benthic area disturbance by alternative is summarized in Table 3.5.2-2.

Table 3.5.2-2. Benthic resource total acres of permanent seabed disturbance from Alternatives C through F compared to the Proposed Action

Alternative	Difference in Area of Benthic Disturbance [a]
C-1: Onshore Aquidneck Island Route	52 acres less
C-2: Onshore Little Compton/Tiverton Route	70 acres less
D: Nantucket Shoals (Removal of up to six WTGs)	72 acres less
E-1: All Piled Foundation Structures	Same as Proposed Action
E-2: All Suction Bucket Foundation Structures	336 acres more
E-3: All Gravity-Based Foundation Structures	1,317 acres more
F: Muskeget Channel Cable Modification	700 acres less

[a] Differences in this table are based on an assumed use of all pin pile foundation for the Proposed Action for purposes of comparison. Physical seabed disturbance is compared within the geographic analysis area.

3.5.2.11 Proposed Mitigation Measures

Additional mitigation measures identified by BOEM and cooperating agencies as a condition of state and federal permitting, or through agency-to-agency negotiations, are described in detail in Appendix G, Tables G-2 through G-4 and summarized and assessed in Table 3.5.2-3. If one or more of the measures analyzed here are adopted by BOEM or cooperating agencies, some adverse impacts on benthic resources could further be reduced. The Draft EIS analyzed a BOEM-proposed measure for fisheries and benthic habitat monitoring surveys. Fisheries and benthic habitat monitoring survey plans were subsequently developed by the Lessee and are analyzed as part of the Proposed Action in the Final EIS.

Table 3.5.2-3. Mitigation and Monitoring Measures Resulting from Consultations (also identified in Appendix G, Table G-2): benthic resources

Measure	Description	Effect
EFH Conservation Recommendations	EFH Conservation Recommendations from NMFS were transmitted by letter dated September 23, 2024. EFH Conservation Recommendations for activities under BOEM's jurisdiction were provided for WTG and cable installation and relocation (micrositing), anchoring, temperate reef avoidance, spill prevention, anti-corrosion	Implementation of Conservation Recommendations, including micrositing WTGs and cables, scour protection material and avoidance, anchoring avoidance and practices, reduced distance in boulder/cobble relocation, sand bedform removal avoidance, conservation of submarine topography and benthic features, overtrenching and sufficient

Measure	Description	Effect
	measures, habitat alteration minimization, boulder relocation, marine debris removal, scour protection, noise mitigation, contents Implementation of Conservation Recommendations, including micrositing WTGs and cables, scour protection material and avoidance, anchoring avoidance and practices, reduced distance in boulder/cobble relocation, sand bedform removal avoidance, conservation of submarine topography and benthic features, overtrenching and sufficient cable burial depth, cable cross-mapping, and seafloor. EFH Conservation Recommendations for activities under USACE's jurisdiction were provided for inshore/estuarine habitat impact minimization, mitigation of impacts on scientific surveys, temperate reef avoidance and in situ impact monitoring, and provision of locations of relocated boulders, created berms, and scour protection.	cable burial depth, cable cross-mapping, and seafloor surveying and monitoring would minimize known or reasonably foreseeable adverse impacts on benthic habitats and features, sensitive habitats, sand bedforms, Nantucket shoals, NOAA Complex Category habitats, the Sakonnet River, Mount Hope Bay, Southern New England HAPC, and the Narragansett Bay Estuary minimizing the potential for elimination/conversion of existing benthic habitats. Conservation Recommendations for inshore/estuarine and nearshore areas, including the use of HDD, micrositing, and re-rerouting during cable installation, the avoidance of sidecasting and open-water disposal during trenching activities, the use of a closed clamshell/environmental bucket dredge and upland disposal during dredging activities in areas with elevated levels of contaminants, and the restoration of disturbed areas to preconstruction conditions would minimize impacts on inshore/estuarine and nearshore benthic habitats and species. Conservation Recommendations for noise during construction, such as the use of additional noise dampening/mitigation measures during all impact pile driving, mandatory quiet periods during pile driving of at least 4 hours per 24 hours, and noise mitigation protocols in consultation with resource agencies prior to construction activities, would avoid and minimize potential noise impacts on benthic species and habitat. Conservation Recommendations for spill preventative measures, anti-corrosion measures, and marine debris removal would minimize potential impacts from any marine debris collected during pre-lay grapnel runs and chemicals, contaminant emissions, anti-corrosive coatings and sacrificial anodes to benthic habitats and species. Conservation Recommendations to revise the Benthic Habitat Monitoring Plan would benefit benthic habitat and species by ensuring robust experimental design, methods, and data collection/analysis to assess changes in benthic communities in the Project area. The Conservation Recommendation to mitigate impacts on NMFS scientific surveys would ensure that NMFS can continue to monitor the

Measure	Description	Effect
		status and health of trust resources. The Conservation Recommendations to develop a Project-specific in situ Monitoring Program and to perform pre-, during, and post-construction in situ monitoring of temperate reefs would benefit benthic habitat and species by assessing the stressors created by Project operation on benthic communities in the Project area, and stressors created by Project construction and operation on temperate reefs, from the presence of turbines, construction and operational noise, heat and EMF exposure, and oceanic-wind wake effects, as well as monitor impacts on fish behavior, species occurrence, community composition, and density and abundance on temperate reefs. Conservation Recommendations to provide the locations of relocated boulders, created berms, scour protection, and cables requiring wet storage to relevant marine users would minimize impacts on benthic habitat by reducing the potential of gear obstructions, which would disturb benthic habitat. Although the Conservation Recommendations would provide incremental reductions in impacts on sensitive and complex habitats and temperate reefs, reductions in the overall impact rating are not anticipated for any of the Proposed Action's IPFs.

Table 3.5.2-4. BOEM or agency-proposed measures (also identified in Appendix G, Table G-3): benthic resources

Measure	Description	Effect
Pile-driven foundations only	Only monopile or piled jacket foundations may be used in the enhanced mitigation area, which would minimize the overall structure impact on benthic prey species.	This would mean a total reduction in seabed footprint for the WTG in the enhanced mitigation area.
Sand Wave Leveling and Boulder Clearance	Sand wave leveling and boulder clearance should be limited to the extent practicable. Best efforts should be made to microsite to avoid these areas.	Sediments in the Project area may be subjected to disturbance from storms, and natural currents would likely reform natal soft-bottom features such as sand waves in the short term. Hard-bottom habitat such as boulders provides heterogeneity in an area otherwise dominated by soft sediments. This measure would decrease impacts on sand waves and boulders in the Project area; however, this measure will not reduce the impact rating for any of the Proposed Action's IPFs.

Measures Incorporated in the Preferred Alternative

Mitigation measures required through completed consultations, authorizations, and permits listed in Table 3.5.2-3 and Tables G-2 through G-4 in Appendix G are incorporated into the Preferred Alternative. These measures, if adopted, would have the effect of reducing the potential for interactions with sensitive and complex benthic habitats, inshore/estuarine and nearshore habitats, and temperate reef habitat, as well as reducing impacts on benthic resources related to EMFs, noise, marine debris, contaminant emissions, anti-corrosive measures, anchoring, scour protection, gear obstructions, and cable emplacement and maintenance. While the impact determination for benthic resources described in Section 3.5.2.5, *Impacts of Alternative B – Proposed Action on Benthic Resources,* would not change, these measures would ensure the effectiveness of, and compliance with, environmental protection measures already analyzed as part of the Proposed Action.

3.5 Biological Resources

3.5.3 Birds

This section discusses potential impacts on bird resources from the proposed Project, alternatives, and ongoing and planned activities in the geographic analysis area for birds. The geographic analysis area for birds, as shown on Figure 3.5.3-1, includes the United States coastline from Maine to Florida; the offshore limit is 100 miles (161 kilometers) from the Atlantic shore and the onshore limit is 0.5 mile (0.8 kilometer) inland. The geographic analysis area was established to capture resident species and migratory species that winter as far south as South America and the Caribbean, and those that breed in the Arctic or along the Atlantic Coast that travel through the area. The offshore limit was established to cover the migratory movement of most species in this group. The onshore limit was established to cover onshore habitats used by the species that may be affected by onshore and offshore components of the proposed Project.

3.5.3.1 Description of the Affected Environment

This section discusses bird species that use onshore and offshore habitats, including both resident bird species that use the proposed Project area during all (or portions of) the year and migrating bird species with the potential to pass through the proposed Project area during fall migration, spring migration, or both. Detailed information regarding habitats and bird species potentially present can be found in COP Volume 2, Section 6.1 and Appendix J (SouthCoast Wind 2024). Given the differences in life history characteristics and habitat use between offshore and onshore bird species, the following provides a separate discussion of each group. This section also discusses bald and golden eagles. This section addresses federally listed threatened and endangered birds; BOEM prepared a BA for USFWS analyzing the effects of the Project on listed species per ESA Section 7 requirements (BOEM 2023). Results of ESA consultation with USFWS are presented in Section 3.5.3.5, *Impacts of Alternative B – Proposed Action on Birds*.

The Atlantic Coast plays an important role in the ecology of many bird species. The Atlantic Flyway is a major route for migratory birds in the eastern United States and Canada, which are protected under the Migratory Bird Treaty Act of 1918. Chapter 4.2.4 of the Atlantic OCS Proposed Geological and Geophysical Activities Programmatic EIS (BOEM 2014a) discusses the use of Atlantic Coast habitats by migratory birds. Birds in the geographic analysis area are subject to pressure from ongoing activities, such as onshore construction, marine minerals extraction, port expansions, and installation of new structures in the OCS, but particularly from accidental releases; new cable, transmission line, and pipeline emplacement; interactions with fisheries and fishing gear; and climate change. More than one-third of bird species that occur in North America (37 percent, 432 species) are at risk of extinction unless significant conservation actions are taken (NABCI 2016). This is likely representative of the conditions of birds in the geographic analysis area.

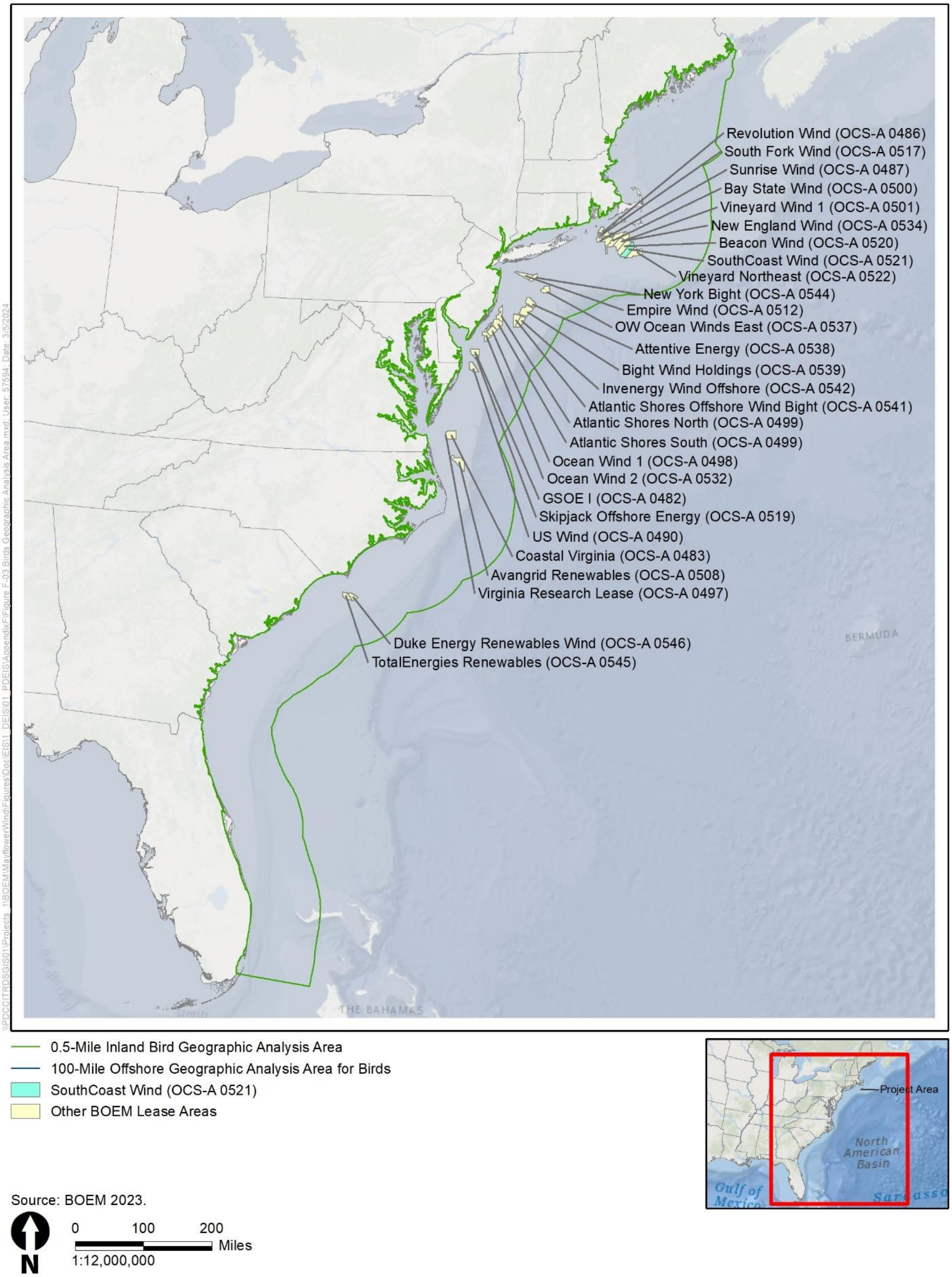


Figure 3.5.3-1. Birds geographic analysis area

Species that live or migrate through the Atlantic Flyway have historically been, and will continue to be, subject to a variety of ongoing anthropogenic stressors, including hunting pressure (approximately 86,000 seaducks are harvested annually [Roberts 2019]), commercial fisheries by-catch (approximately 2,600 seabirds are killed annually on the Atlantic [Hatch 2017; Sigourney et al. 2019]), and climate change, which has the potential for adverse impacts on birds.

According to the North American Bird Conservation Initiative (NABCI), more than half of the offshore bird species (57 percent, 31 species) have been placed on the NABCI watch list as a result of small ranges, small and declining populations, and threats to required habitats. This watch list identified species of high conservation concern based upon high vulnerability to a variety of factors, including population size, breeding distribution, non-breeding distribution, threats to breeding, threats to non-breeding, and population trend (NABCI 2016). Globally, monitored offshore bird populations have declined by nearly 70 percent from 1950 to 2010, which may be representative of the overall population trend of seabirds (Paleczny et al. 2015) including those that forage, breed, and migrate over the Atlantic OCS. Overall, offshore bird populations are decreasing; however, considerable differences in population trajectories of offshore bird families have been documented.

Coastal birds, especially those that nest in coastal marshes and other low-elevation habitats, are vulnerable to sea-level rise and the increasing frequency of strong storms as a result of global climate change. According to NABCI, nearly 40 percent of the more than 100 bird species that rely on coastal habitats for breeding or for migration are on the NABCI watch list. Many of these coastal species have a small population size or restricted distributions, making them especially vulnerable to habitat loss or degradation and other stressors (NABCI 2016). Models of vulnerability to climate change estimate that, throughout Massachusetts, 42 percent of Massachusetts' 252 bird species and, throughout Rhode Island, 28 percent of Rhode Island's 197 bird species are vulnerable to climate change across seasons (Audubon 2019), some of which occur in the geographic analysis area. These ongoing impacts on birds would continue regardless of the offshore wind industry.

A broad group of avian species may pass through the Project area, including migrants (such as raptors and songbirds), coastal birds (such as shorebirds, waterfowl, and waders), and marine birds (such as seabirds and seaducks). Approximately 106 species of birds that are federally or state-listed or are species of conservation concern (i.e., federal Birds of Conservation Concern or state Species of Greatest Conservation Need) were identified as potentially occurring in the Project area based on literature reviews, review of public databases, and results of surveys conducted in and around the Project area, including long-term local or regional survey efforts in the Massachusetts/Rhode Island offshore wind Lease Area (refer to COP Volume 2, Section 6.1.1; SouthCoast Wind 2024), and project-specific surveys to support the Avian Exposure Risk Assessment (COP Appendix I1, Section 2.2.3; SouthCoast Wind 2024). Of these 106 species, 2 are federally listed as threatened, 1 is federally listed as endangered, 1 is protected under the Bald and Golden Eagle Protection Act (BGEPA), 27 are state-listed under the Massachusetts Endangered Species Act (MESA), 61 are listed as MESA Species of Greatest Conservation Need (SGCN), 25 are state-listed in Rhode Island, 51 are SGCN in Rhode Island, and 34 are listed as USFWS Birds of Conservation Concern (BCC) species. There is high diversity of marine birds that may use the Offshore Project area because it is in the Mid-Atlantic Bight, which overlaps with the ranges of both the northern and southern species and falls within the Atlantic Flyway. Migrant terrestrial species may follow the coastline on their annual trips or choose more direct flight routes over expanses of open water. Many marine birds also make annual migrations up and down the Eastern Seaboard (e.g., gannets, loons, and seaducks), taking them directly through the Atlantic region in spring and fall. This results in a complex ecosystem where the community composition shifts regularly, and temporal and geographic patterns are highly variable. The mid-Atlantic supports large populations of birds in summer, some of which breed in the area, such as coastal gulls and terns. Other summer residents, such as shearwaters and storm-petrels, visit from the Southern Hemisphere (where they breed during the austral summer). In the fall, many of the summer residents leave the area and migrate south to warmer climates and are replaced by species that breed farther north and winter in the mid-Atlantic. Table 3.5.3-1 summarizes the bird presence in the Offshore Project area by bird type.

Table 3.5.3-1. Bird presence in the Offshore Project area by bird type

Bird Type	Potential Bird Presence in the Offshore Project Area
Non-Marine Migratory Birds	
Shorebirds	Shorebirds are coastal breeders and foragers and avoid straying out over deep waters during breeding. Of the shorebirds, red phalarope (*Phalaropus fulicarius*) and red-necked phalarope (*Phalaropus lobatus*) have a greater potential to occur in the marine environment as they forage over the open ocean during both non-breeding and breeding seasons. Phalarope species were observed during Aerial HD surveys in the spring and fall. MDAT abundance models and MCEC surveys indicate red phalarope occurrence is uncommon in spring and that red-necked phalarope occurrence is rare in spring in the Lease Area. Overall, exposure of shorebirds to the offshore infrastructure will be limited to migration, and, apart from phalaropes, the offshore marine environment does not provide habitat for shorebirds.
Wading birds	Most long-legged wading birds breed and migrate in coastal and inland areas. Like the smaller shorebirds, wading birds are coastal breeders and foragers and generally avoid straying out over deep waters but may traverse the Wind Farm Area during spring and fall migration periods. No wading birds were recorded in the Lease Area during offshore surveys (Veit et al. 2016) including the 2019–2020 Aerial HD surveys. The USFWS IPaC database identified five bird species that are listed as BCC, and two great blue herons (*Ardea herodia*) were observed during the October–November 2019 boat-based G&G surveys (RPS Group 2020, 2019).
Raptors	Except for falcons, most raptors do not fly in the offshore marine environment due to their wing morphology, which requires thermal column formation to support their gliding flight. Falcons are encountered offshore because they can make large water crossings. Merlins (*Falco sparverius*) and peregrine falcons (*Falco peregrinus*) are commonly observed offshore, fly offshore during migration, and have been observed on offshore oil platforms. Therefore, falcons may pass through the Wind Farm Area during migration. Ospreys fly over open water crossings; however, satellite telemetry data from ospreys in New England and the mid-Atlantic suggest these birds generally follow coastal or inland migration routes. No peregrine falcons were observed in the Lease Area during offshore surveys (Veit et al. 2016) including the 2019–2020 Aerial HD surveys. However, one peregrine falcon was observed during the October–November 2019 boat-based G&G surveys (RPS Group 2020, 2019).

Bird Type	Potential Bird Presence in the Offshore Project Area
Songbirds	Songbirds almost exclusively use terrestrial, freshwater, and coastal habitats and do not use the offshore marine system except during migration. Songbirds regularly cross large bodies of water, and there is some evidence that species migrate over the northern Atlantic. Some birds may briefly fly over the water while others, like the blackpoll warbler (*Setophaga striata*), can migrate over vast expanses of ocean (DeLuca et al. 2015; Faaborg et al. 2010). Evidence for a variety of species suggests that overwater migration in the Atlantic is much more common in fall (than in spring), when the frequency of overwater flights increases perhaps due to consistent tailwinds from the northwest. Overall, the exposure of songbirds to the Wind Farm Area will be limited to migration. Common songbirds that were observed during G&G surveys included mourning dove (*Zenaida macroura*), northern cardinal (*Cardinalis cardinalis*), northern flicker (*Colaptes auratus*), and golden-crowned kinglet (*Regulus satrapa*), among others (RPS Group 2020, 2019). Additionally, during the October–November 2019 G&G surveys, a marsh wren (*Cistothorus palustris*) was observed.
Coastal waterbirds	Coastal waterbirds (including waterfowl) use terrestrial or coastal wetland habitats and rarely use the marine offshore environment. The species in this group are generally restricted to freshwater or use saltmarshes, beaches, and other strictly coastal habitats and are unlikely to pass through the Wind Farm Area. Seaducks are discussed below in the marine bird section.
Marine Birds	
Loons and grebes	Common loons (*Gavia immer*) and red-throated loons (*Gavia stellate*) use the Atlantic OCS in winter. Analysis of satellite-tracked red-throated loons, captured and tagged in the mid-Atlantic area, found their winter distributions to be largely inshore of the mid-Atlantic, and this species is known to use the Nantucket Shoals located northeast of the Lease Area (Gray et al. 2017). The red-throated loon was observed in the Lease Area during spring MCEC surveys and observed in the fall and several observed in spring during Aerial HD surveys. Additionally, portions of the 75% and 95% isopleths overlap the Lease Area. The common loon was observed during the October–November 2019 boat-based G&G surveys. The MDAT abundance models and MCEC surveys indicate that red-throated loons are generally concentrated closer to shore and in the Nantucket Shoals during fall and winter. Grebes occur in nearshore marine environments during the winter in Massachusetts. MDAT models, MCEC surveys, and site-specific surveys indicate the occurrence of horned grebe (*Podiceps auratus*) is expected to be rare and limited to winter.
Seaducks	The seaducks use the Atlantic OCS heavily in winter. Most seaducks forage on mussels and other benthic invertebrates, and generally winter in shallower inshore waters or out over large offshore shoals, where they can access benthic prey. Regional MDAT abundance models and MCEC surveys indicate sea ducks are concentrated close to shore and in the Nantucket Shoals, which is recognized as an important wintering area (Veit et al. 2016; Silverman et al. 2013). Exposure to the Lease Area varies from rare to common with most seaducks occurring in winter and early spring. During Aerial HD surveys, black scoter, common eider, long-tailed duck, surf scooter, and white-winged scooter were observed (COP Appendix I1, Figure 3-45; SouthCoast Wind 2024).
Petrel group	Shearwaters, petrels, and storm-petrels are pelagic seabirds that only occur on land during the breeding season. These species use the Atlantic OCS region heavily, including in the Massachusetts/Rhode Island offshore wind Lease Area in the summer (Veit et al. 2016; Veit et al. 2015; Nisbet et al. 2013). However, the northern fulmar (*Fulmarus glacialis*) is primarily observed during the winter, and the black-capped petrel *(Pterodroma hasitata)* and band-rumped storm-petrel (*Oceanodroma castro*) are rare visitors in the winter. The regional MDAT models and MCEC surveys indicate that the occurrences in the Lease Area for shearwaters, petrels, and storm-petrels range from rare to common, and Cory's shearwater (*Calonectris borealis*), great shearwater (*Ardenna gravis*), and northern fulmar (*Fulmaris glacialis*) occurrence is common. Shearwaters, storm-petrel, and fulmar species were observed during the Aerial HD surveys and

Bird Type	Potential Bird Presence in the Offshore Project Area
	included Cory's shearwater, greater shearwater, sooty shearwater, and northern fulmar. Additionally, during G&G vessel surveys completed in the Lease Area from October–November, the great shearwater was observed (92 observations representing 199 individuals).
Gannets and cormorants	Northern gannets use the Atlantic OCS primarily during winter. They breed in southeastern Canada and winter along the U.S. Atlantic Coast, with concentration observed near the OCS of Massachusetts. The northern gannet was observed in the Lease Area in all seasons during MCEC surveys, and in the spring, winter, and fall during Aerial HD surveys. During the October–November G&G surveys, over 400 individuals were observed in the Lease Area and six were observed during the Project G&G surveys in September 2019. GPS tracking data of the northern gannet did not indicate that core use areas occur in the Lease Area; however, portions of the 75% and 95% isopleths overlap the Lease Area. Based on MDAT abundance models, MCEC surveys, and site-specific surveys, northern gannet occurrence in the Lease Area is common during spring, fall, and winter, and rare in summer. Additionally, unidentified cormorants were observed during Aerial HD surveys in the spring and fall. The double-crested cormorant is commonly observed year-round on coastlines in Massachusetts and Rhode Island, and regional MDAT abundance models and MCEC surveys further corroborate this, indicating that cormorants are concentrated closer to shore and not commonly encountered well offshore.
Gulls, skuas, and jaegers	Several species in this group were observed during Aerial HD surveys and could potentially pass through the Wind Farm Area (COP Appendix I1, Figure 3-48; SouthCoast Wind 2024). Gulls are primarily coastal species but may occur offshore. MCEC surveys documented large gulls such as the herring gulls (*Larus argentatus*) and great-black-backed gull (*Larus marinus*) offshore outside of breeding season (Veit et al. 2016), and G&G vessel surveys completed in the Lease Area during October–November were dominated by the herring gull; (59 observations representing 572 individuals). Jaegers and skuas reside in the marine environment outside of breeding season. The parasite jaeger (*Stercorarius parasiticus*) and pomarine jaeger (*Stercorarius pomarinus*) migrate through the North Atlantic region and breed in the Arctic. Both jaegers and skuas in the Lease Area is rare in spring, summer, and fall.
Terns	Terns generally restrict themselves to coastal waters during breeding, although they may pass through the Wind Farm Area infrequently to forage and during migration. The MDAT abundance models and MCEC surveys indicate that terns are primarily concentrated close to shore. Conventional aerial surveys identified hotspots of roseate tern abundance on the western side of the Nantucket Shoals and in the Muskeget Channel between Martha's Vineyard and Muskeget during the spring (Veit et al. 2016). Migration routes of roseate terns are not well known but are believed to be largely or exclusively pelagic in both spring and fall; therefore, roseate terns may pass through the Lease Area during this period (Veit et al. 2016; Normandeau Associates Inc. 2011). Common terns (*Sterna hirundo*) were observed in the Lease Area during Aerial HD surveys in spring only (SouthCoast Wind 2024) and in two BOEM blocks adjacent to the Lease Area during MCEC surveys. The roseate tern (*Sterna dougalli*) was observed in the Lease Area during Aerial HD surveys in spring only (SouthCoast Wind 2024) and in one BOEM block during summer MCEC surveys. Based on MDAT abundance models, MCEC surveys, and Aerial HD surveys, the occurrence of roseate tern in the Lease Area is expected to be rare in the spring and fall.
Auks	Four species in this group were observed during Aerial HD surveys and could potentially pass through the Wind Farm Area (COP Appendix I1, Figure 3-43; SouthCoast Wind 2024). Auk species present in the region are generally northern or Arctic breeders and are marine species outside of their breeding seasons. Auks may occur in the Lease Area during any season; however, most species are primarily observed during the spring and winter.

Source: SouthCoast Wind 2024.
G&G = geological and geophysical; IPaC = Information for Planning and Consultation; MDAT = Marine-life Data and Analysis Team; MCEC = Massachusetts Clean Energy Center.

Due to the variety of upland, wetland, and coastal habitats in the Falmouth and Brayton Point Onshore Project areas (COP Appendix J, Figures 4-2 through 4-8; SouthCoast Wind 2024) and their location in the Atlantic Flyway, a broad group of avian species utilize these onshore habitats during breeding, wintering, and migration periods. The avian groups found in these habitats include songbirds, shorebirds, raptors, waterfowl, waders, and seabirds. These birds include 55 species that are federally listed as threatened and endangered, USFWS-designated BCC, state-listed threatened and endangered, and state Special Concern birds (COP Appendix J, Table 4-10; SouthCoast Wind 2024). The Onshore Project areas are in Bird Conservation Region 30, which is an area defined by the USFWS to facilitate use and interpretation of USFWS-designated BCC. The JBCC, which is located in proximity to Falmouth Onshore Project features, is designated as a National Audubon Society Important Bird Area. The Brayton Point Onshore Project area is directly adjacent to the Lee and Cole Rivers Important Bird Area, which serves as habitat for a significant population of waterfowl and covers 2,569 acres (1,040 hectares) (Audubon n.d.).

The Falmouth Onshore Project area is located in the USEPA Atlantic Coastal Pine Barren Level III Ecoregion and intersects Massachusetts's Natural Heritage and Endangered Species Program Priority Habitat 945 and Estimated Habitat 756 (MassWildlife 2020). Priority Habitat is based on the known geographical extent of habitat for all state-listed rare species and Estimated Habitats are subsets of the Priority Habitats based on the geographical extent of habitat of state-listed rare wetlands wildlife. See COP Appendix J, Table 4-8 (SouthCoast Wind 2024) for a list of species, including birds, identified in the National Heritage and Endangered Species Program Priority Habitat and Estimated Habitat for the Falmouth Onshore Project area. The Brayton Point Onshore Project area is located within the USEPA Northeastern Coastal Zone. The Onshore Project area in Brayton Point, or portion thereof, is located within Priority Habitat 387 and Estimated Habitat 353 (COP Appendix J; SouthCoast Wind 2024). See COP Appendix J, Table 4-9 (SouthCoast Wind 2024) for a list of Rhode Island Species of Concern identified near the Brayton Point Onshore Project area.

Bald eagles (*Haliaeetus leucocephalus*), which are listed as Threatened under MESA, and as SGCN in Massachusetts and Rhode Island, are federally protected by the BGEPA, 16 USC 668 et seq., as are golden eagles (*Aquila chrysaetos*). Bald eagles are broadly distributed across North America and generally nest and perch in areas associated with water (lakes, rivers, bays) in both freshwater and marine habitats, often remaining largely within roughly 1,640 feet (500 meters) of the shoreline. Bald eagles are present year-round in Massachusetts and can primarily be found in terrestrial environments near water and overwinter along the coast of Cape Cod, Martha's Vineyard, and Nantucket (MassWildlife 2019). The general morphology of bald eagles dissuades long-distance movements in offshore settings, as the species generally relies upon thermal formations, which develop poorly over the open ocean, during long-distance movements. As such, bald eagles are unlikely to fly through the Wind Farm Area. The bald eagle may be present in the Onshore Project areas and immediate vicinity. The statewide breeding population is increasing (MassWildlife 2020), and, in spring 2020, a new bald eagle nest was observed on Cape Cod in Barnstable. However, no known bald eagle nesting sites have been observed in the Onshore Project areas (MassWildlife 2020). In Rhode Island, populations of bald eagles have increased since the 1960s with 100 sightings reported during 2018, 19 of which occurred on

Aquidneck Island (Avenego 2018). Although populations of bald eagles in Rhode Island have increased, Project activities are not expected to interfere with the species.

Golden eagles are found throughout the United States but are rare on the East Coast (Faherty 2016). In Massachusetts, golden eagles are very uncommon to rare fall migrants and winter visitors and are not known to breed within the state (MassAudubon 2022). As with bald eagles, the general morphology of golden eagle dissuades long-distance movements in offshore settings (Kerlinger 1985), as the species generally relies upon thermal formations, which develop poorly over the open ocean, during long-distance movements. As such, golden eagles are unlikely to fly through the Wind Farm Area.

Three species of birds listed as threatened or endangered under the ESA may occur in the Onshore and Offshore Project areas: the threatened piping plover (*Charadrius m. melodus*), endangered roseate tern (*Sterna d. dougallii*), and threatened rufa subspecies of the red knot (*Calidris canutus rufa*) (SouthCoast Wind 2024).

Impacts from reasonably foreseeable offshore wind activities on ESA-listed species will be discussed in detail in subsequent project-specific analysis documents. As is the case with the proposed SouthCoast Wind Project, each proposed project will be required to address ESA-listed species at the individual project scale and cumulatively. Additionally, BOEM is currently working on a programmatic framework for ESA consultation with USFWS to address the potential impacts of the anticipated development of Atlantic offshore wind energy facilities on ESA-listed species.

3.5.3.2 Impact Level Definitions for Birds

Impact level definitions for birds are provided in Table 3.5.3-2.

Table 3.5.3-2. Definitions of impact levels for birds

Impact Level	Type of Impact	Definition
Negligible	Adverse	Impacts would be so small as to be unmeasurable.
	Beneficial	Impacts would be so small as to be unmeasurable.
Minor	Adverse	Most impacts would be avoided; if impacts occur, the loss of one or few individuals or temporary alteration of habitat could represent a minor impact, depending on the time of year and number of individuals involved.
	Beneficial	Impacts would be localized to a small area but with some measurable effect on one or a few individuals or habitat.
Moderate	Adverse	Impacts would be unavoidable but would not result in population-level effects or threaten overall habitat function.
	Beneficial	Impacts would affect more than a few individuals in a broad area but not regionally and would not result in population-level effects.
Major	Adverse	Impacts would result in severe, long-term habitat or population-level effects on species.
	Beneficial	Long-term beneficial population-level effects would occur.

3.5.3.3 Impacts of Alternative A – No Action on Birds

When analyzing the impacts of the No Action Alternative on birds, BOEM considered the impacts of ongoing activities, including ongoing non-offshore wind and ongoing offshore wind activities on the baseline conditions for birds. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities, as described in Appendix D*, Planned Activities Scenario*.

Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for birds described in Section 3.5.3.1, *Description of the Affected Environment and Future Baseline Conditions,* would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities. Ongoing non-offshore wind activities within the geographic analysis area that contribute to impacts on birds are generally associated with onshore impacts (including onshore construction and coastal lighting), activities in the offshore environment (e.g., vessel traffic, commercial fisheries), and climate change. Onshore construction activities and associated impacts are expected to continue at current trends and have the potential to affect bird species through temporary and permanent habitat removal or conversion, temporary noise impacts related to construction, collisions (e.g., presence of structures), and lighting effects, which could cause avoidance behavior and displacement, as well as injury or mortality to individual birds. However, population-level effects would not be anticipated. Activities in the offshore environment could result in bird avoidance behavior and displacement, but population-level effects would not be anticipated. Impacts associated with climate change have the potential to result in habitat degradation and loss and shifting of species distribution.

Ongoing offshore wind activities in the geographic analysis area that contribute to impacts on birds include the following.

- Continued O&M of the Block Island project (5 WTGs) installed in State waters.
- Continued O&M of the CVOW-Pilot project (2 WTGs) installed in OCS-A 0497.
- Ongoing construction of multiple offshore wind projects: the Vineyard Wind 1 project (62 WTGs and 1 OSS) in OCS-A 0501 and the South Fork project (12 WTGs and 1 OSS) in OCS-A 0517, Revolution Wind project (65 WTGs and two OSPs) in OCS-A 0486, Ocean Wind 1 (98 WTGs and three OSPs) in OCS-A 0498, Empire Wind (147 WTGs and two OSPs) in OCS-A 0512, and CVOW-Commercial (176 WTGs and three OSPs) in OCS-A 0483.

Ongoing O&M of Block Island and CVOW-Pilot projects and ongoing construction of multiple offshore wind projects would affect birds through the primary IPFs of accidental releases, lighting, cable emplacement and maintenance, noise, presence of structures, traffic (aircraft), and land disturbance. Ongoing offshore wind activities would have the same type of impacts that are described in *Cumulative Impacts of the No Action Alternative* for ongoing and planned offshore wind activities, but the impacts would be of lower intensity.

Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impact of the No Action Alternative in combination with other planned non-offshore wind activities and planned offshore wind activities (without the Proposed Action).

Planned non-offshore wind activities that may affect birds include installation of new submarine cables and pipelines, increasing onshore construction, marine minerals extraction, port expansions, and installation of new structures on the OCS (see Appendix D, *Planned Activities Scenario,* Section D.2 for a complete description of planned activities). Similar to ongoing activities, planned non-offshore wind activities may result in temporary and permanent impacts on birds including disturbance, displacement, injury, mortality, habitat degradation, and habitat conversion.

The following sections summarize the potential impacts of ongoing and planned offshore wind activities on birds during construction, O&M, and decommissioning of the projects. Planned offshore wind activities include offshore wind energy development activities on the Atlantic OCS other than the Proposed Action determined by BOEM to be reasonably foreseeable (see Appendix D, *Planned Activities Scenario*, Section D.2, for a complete description of planned offshore wind activities).

BOEM expects offshore wind activities may affect birds through the following primary IPFs.

Accidental releases: Accidental releases of fuel/fluids, other contaminants, and trash and debris could occur as a result of offshore wind activities. The risk of any type of accidental release would be increased primarily during construction but may also be present during operations and decommissioning of offshore wind facilities. Hazardous materials that could be released include coolant fluids, oils and lubricants, and diesel fuels and other petroleum products. Ingestion of fuel and other hazardous contaminants has the potential to result in lethal and sublethal impacts on birds, including decreased hematological function, dehydration, drowning, hypothermia, starvation, and weight loss (Briggs et al. 1997; Haney et al. 2017; Paruk et al. 2016). Additionally, even small exposures that result in oiling of feathers can lead to sublethal effects that include changes in flight efficiencies and increased energy expenditure during daily and seasonal activities, including chick provisioning, commuting, courtship, foraging, long-distance migration, predator evasion, and territory defense (Maggini et al. 2017). Based on the volumes potentially involved (Appendix D, Table D2-3), the likely amount of releases associated with offshore wind development would fall within the range of accidental releases that already occur on an ongoing basis from non-offshore wind activities, and would represent a negligible impact on birds.

Vessel compliance with USCG regulations would minimize trash or other debris; therefore, BOEM expects accidental trash releases from offshore wind vessels to be rare and localized in nature. In the unlikely event of a release, lethal and sublethal impacts on individuals could occur as a result of blockages caused by both hard and soft plastic debris (Roman et al. 2019). Given that accidental releases are anticipated to be rare and localized, BOEM expects that accidental releases of trash and debris would not appreciably contribute to overall impacts on birds.

Light: Nighttime lighting associated with offshore wind structures and vessels could represent a source of bird attraction. Up to 2,940 offshore WTGs and OSPs would have hazard and aviation lighting that would be incrementally added beginning in 2023 and continuing through 2030. Vessel lighting would result in localized and temporary impacts on birds; structure lighting may pose an increased collision or predation risk (Hüppop et al. 2006), although this risk would be localized in extent and minimized through the use of BOEM lighting guidelines (BOEM 2021; Kerlinger et al. 2010). Overall, BOEM anticipates lighting impacts related to offshore wind structures and vessels would be negligible.

Cable emplacement and maintenance: Generally, emplacement of submarine cables would result in increased suspended sediments that may affect diving birds, result in displacement of foraging individuals, or decreased foraging success, and have impacts on some prey species (e.g., benthic assemblages) (Cook and Burton 2010). Impacts associated with cable emplacement would be temporary and localized, and birds would be able to successfully forage in adjacent areas not affected by increased suspended sediments. Any dredging necessary prior to cable installation could contribute to additional impacts. Disturbed seafloor from construction of offshore wind projects may affect some bird prey species; however, assuming future projects use installation procedures similar to those proposed in the SouthCoast Wind COP, the duration and extent of impacts would be limited and short term, and benthic assemblages would recover from disturbance. Section 3.5.2, *Benthic Resources*, and Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*, provide more information. Impacts would be negligible because increased suspended sediments would be temporary and generally localized to the emplacement corridor, and no individual fitness or population-level effects on birds would be expected.

Noise: Anthropogenic noise on the OCS associated with offshore wind development, including noise from aircraft, pile-driving activities, G&G surveys, offshore construction, and vessel traffic, has the potential to result in impacts on birds on the OCS. Additionally, onshore construction noise has the potential to result in impacts on birds. BOEM anticipates that noise impacts would be negligible because noise would be localized and temporary. Potential impacts could be greater if avoidance and displacement of birds occurs during seasonal migration periods.

Aircraft flying at low altitudes may cause birds to flush, resulting in increased energy expenditure. Disturbance to birds, if any, would be temporary and localized, with impacts dissipating once the aircraft has left the area. No individual or population-level effects would be expected.

Construction of up to 2,940 offshore structures would create noise and may temporarily affect diving birds. The greatest impact of noise is likely to be caused by pile-driving activities during construction. Noise transmitted through water has the potential to result in temporary displacement of diving birds in a limited space around each pile and can cause short-term stress and behavioral changes ranging from mild annoyance to escape behavior (BOEM 2014b, 2016). Additionally, noise impacts on prey species may affect bird foraging success. Similar to pile driving, G&G site characterization surveys for offshore wind facilities would create high-intensity impulsive noise around sites of investigation, leading to similar impacts on birds.

Onshore noise associated with intermittent construction of required offshore wind development infrastructure may also result in localized and temporary impacts, including avoidance and displacement, although no individual fitness or population-level effects would be expected to occur.

Noise associated with project vessels could disturb some individual diving birds, but they would likely acclimate to the noise or move away, potentially resulting in a temporary loss of habitat (BOEM 2012). However, brief, temporary responses, if any, would be expected to dissipate once the vessel has passed or the individual has moved away. No individual fitness or population-level effects would be expected.

Presence of structures: The presence of structures can lead to impacts, both beneficial and adverse, on birds through fish aggregation and associated increase in foraging opportunities, as well as entanglement and gear loss or damage, migration disturbances, and WTG strikes and displacement. These impacts may arise from buoys, meteorological towers, foundations, scour and cable protections, and transmission cable infrastructure.

The primary threat to birds from the presence of structures would be from collision with WTGs. The Atlantic Flyway is an important migratory pathway for as many as 164 species of waterbirds, and a similar number of land birds, with the greatest volume of birds using the Atlantic Flyway during annual migrations between wintering and breeding grounds (Watts 2010). Within the Atlantic Flyway along the North American Atlantic Coast, much of the bird activity is concentrated along the coastline (Watts 2010). Waterbirds use a corridor between the coast and several kilometers out onto the OCS, while land birds tend to use a wider corridor extending from the coastline to tens of kilometers inland (Watts 2010). While both groups may occur over land or water within the flyway and may extend considerable distances from shore, the highest diversity and density are centered on the shoreline. Building on this information, Robinson Wilmott et al. (2013) evaluated the sensitivity of bird resources to collision and displacement due to offshore wind development on the Atlantic OCS and included the 164 species selected by Watts (2010) plus an additional 13 species, for a total of 177 species that may occur on the Atlantic OCS from Maine to Florida during all or some portion of the year. As discussed in Robinson Willmott et al. (2013) and consistent with Garthe and Hüppop (2004), Furness and Wade (2012), and Furness et al. (2013), species with high scores for sensitivity for collision include gulls, jaegers, and the northern gannet (*Morus bassanus*). In many cases, high collision sensitivity was driven by high occurrence on the OCS, low avoidance rates with high uncertainty, and time spent in the RSZ. Many of the species addressed in Robinson Willmott et al. (2013) had low collision sensitivity including passerines that spend very little time on the Atlantic OCS during migration and typically fly above the RSZ. As discussed by Watts (2010), 55 bird species occur on the Atlantic OCS at a distance from shore where WTGs could be operating. However, generally the abundance of bird species that overlap with the anticipated development of wind energy facilities on the Atlantic OCS is relatively small (Figure 3.5.3-2). Of the 55 bird species, 47 marine bird species have sufficient survey data to calculate the modeled percentage of a species population that would overlap with the anticipated offshore wind development on the Atlantic OCS (Winship et al. 2018); the relative seasonal exposure is generally very low, ranging from 0.0 to 5.2 percent (Table 3.5.3-3). BOEM assumes that the 47 species (85 percent) with sufficient data to model the relative distribution and abundance on the Atlantic OCS are representative of the 55 species that may overlap with offshore wind development on the Atlantic OCS.

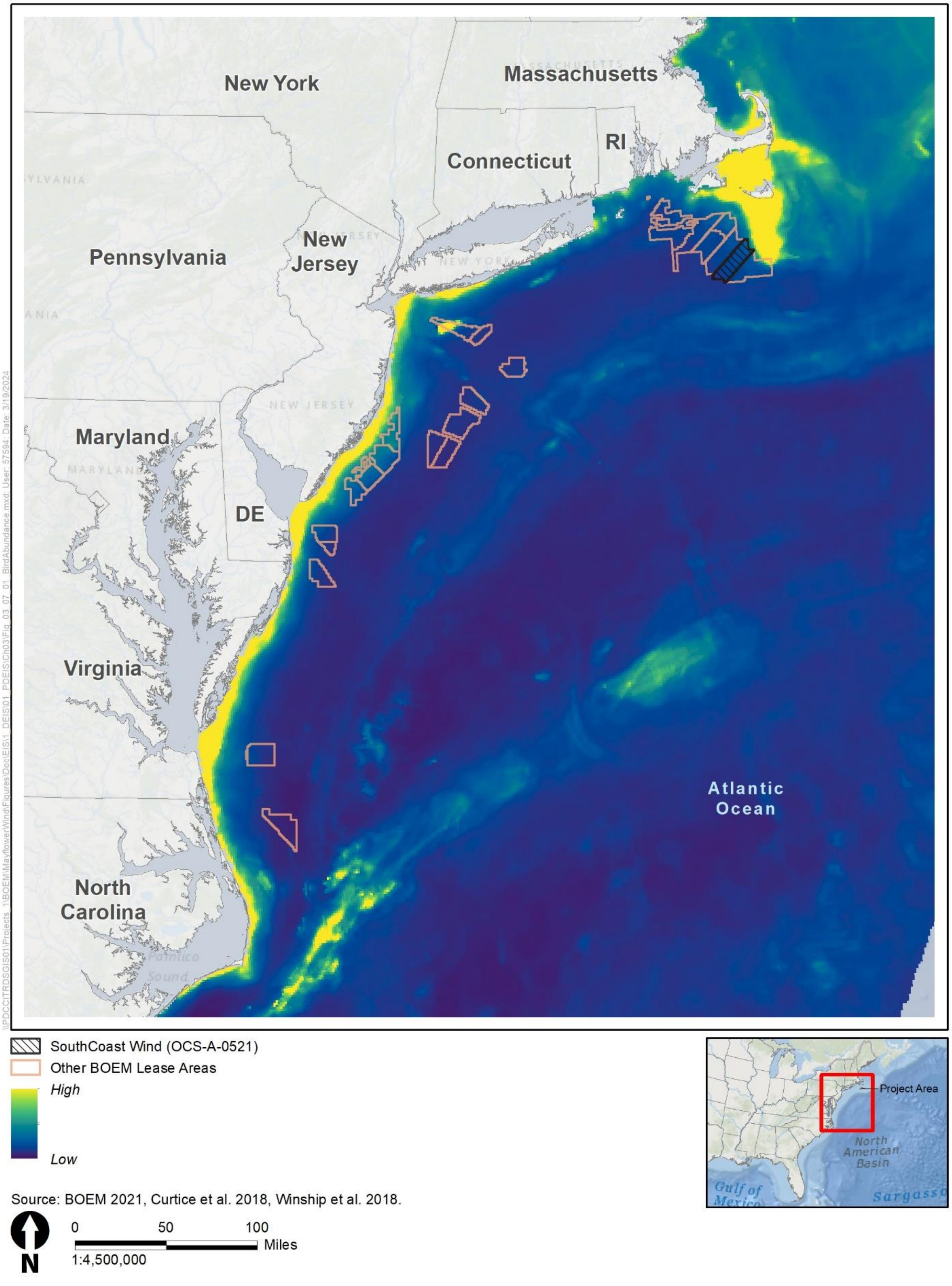


Figure 3.5.3-2. Total avian relative abundance distribution map

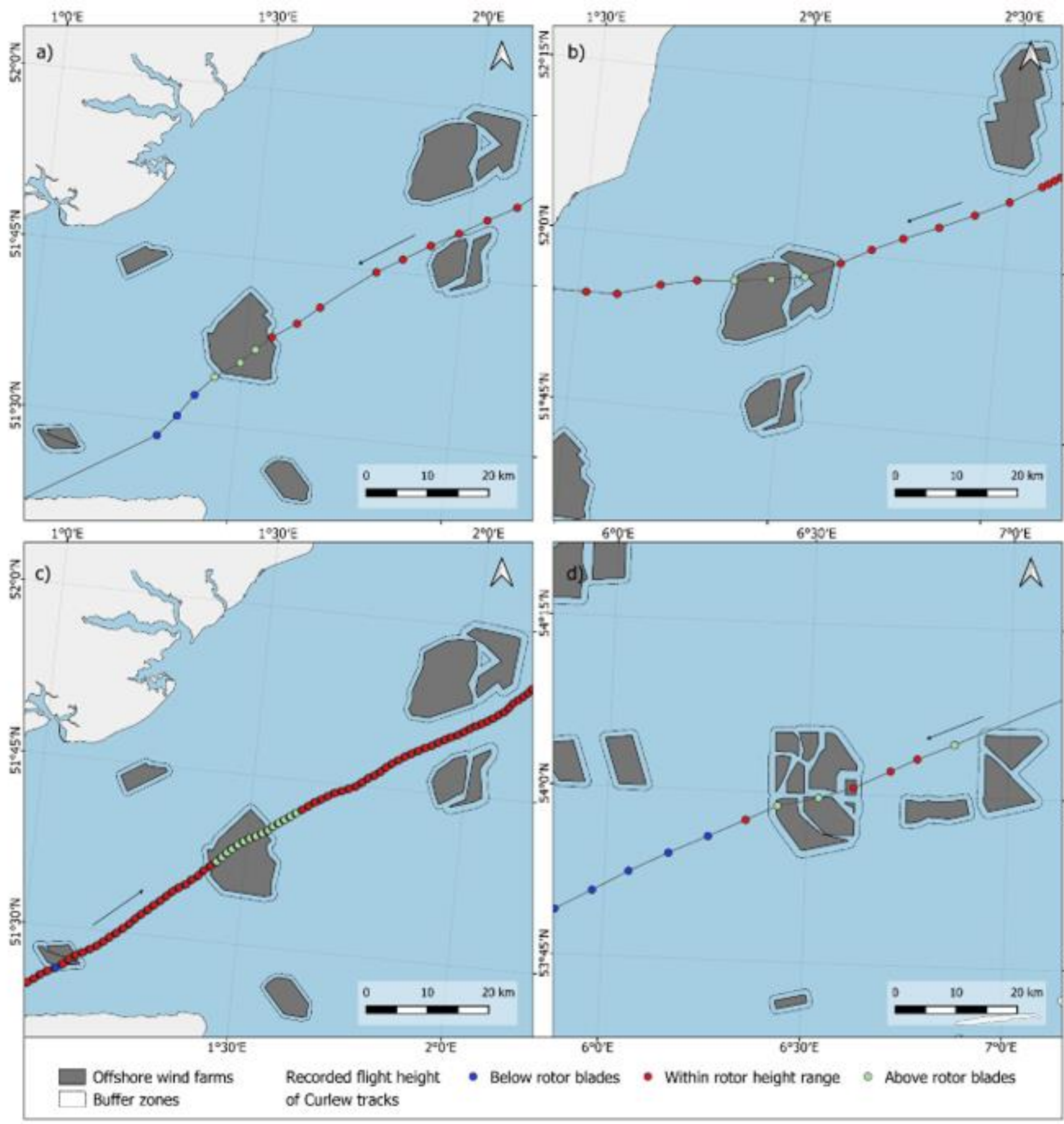
Table 3.5.3-3. Percentage of each Atlantic seabird population that overlaps with anticipated offshore wind energy development on the OCS by season

Species	Spring	Summer	Fall	Winter
Artic tern (*Sterna paradisaea*)	NA	0.2	NA	NA
Atlantic puffin (*Fratercula arctica*) [a]	0.2	0.1	0.1	0.2
Audubon shearwater (*Puffinus lherminieri*) [b]	0.0	0.0	0.0	0.0
Black-capped petrel (*Pterodroma hasitata*) [b]	0.0	0.0	0.0	0.0
Black guillemot (*Cepphus grille*)	NA	0.3	NA	NA
Black-legged kittiwake (*Rissa tridactyla*) [a]	0.7	NA	0.7	0.5
Black scoter (*Melanitta americana*)	0.2	NA	0.4	0.5
Bonaparte's gull (*Chroicocephalus philadelphia*)	0.5	NA	0.4	0.3
Brown pelican (*Pelecanus occidentalis*)	0.1	0.0	0.0	0.0
Band-rumped storm-petrel (*Oceanodroma castro*) [b]	NA	0.0	NA	NA
Bridled tern (*Onychoprion anaethetus*)	NA	0.1	0.1	NA
Common eider (*Somateria mollissima*) [a]	0.3	0.1	0.5	0.6
Common loon (*Gavia immer*)	3.9	1.0	1.3	2.1
Common murre (*Uria aalge*)	0.4	NA	NA	1.9
Common tern (*Sterna hirundo*) [a]	2.1	3.0	0.5	NA
Cory's shearwater (*Calonectris borealis*) [b]	0.1	0.9	0.3	NA
Double-crested cormorant (*Phalacrocorax auritus*)	0.7	0.6	0.5	0.4
Dovekie (*Alle alle*)	0.1	0.1	0.3	0.2
Great black-backed gull (*Larus marinus*) [a]	1.3	0.5	0.7	0.6
Great shearwater (*Puffinus gravis*)	0.1	0.3	0.3	0.1
Great skua (*Stercorarius skua*)	NA	NA	0.1	NA
Herring gull (*Larus argentatus*) [a]	1.0	1.3	0.9	0.5
Horned grebe (*Podiceps auritus*)	NA	NA	NA	0.3
Laughing gull (*Leucophaeus atricilla*)	1.0	3.6	0.9	0.1
Leach's storm-petrel (*Oceanodroma leucorhoa*)	0.1	0.0	0.0	NA
Least tern (*Sternula antillarum*)	NA	0.3	0.0	NA
Long-tailed ducks (*Clangula hyemalis*)	0.6	0.0	0.4	0.5
Manx shearwater (*Puffinus puffinus*) [a, b]	0.0	0.5	0.1	NA
Northern fulmar (*Fulmarus glacialis*) [a]	0.1	0.2	0.1	0.2
Northern gannet (*Morus bassanus*) [a]	1.5	0.4	1.4	1.4
Parasitic jaeger (*Stercorarius parasiticus*)	0.4	0.5	0.4	NA
Pomarine jaeger (*Stercorarius pomarinus*)	0.1	0.3	0.2	NA
Razorbill (*Alca torda*) [a]	5.2	0.2	0.4	2.1
Ring-billed gull (*Larus delawarensis*)	0.5	0.5	0.9	0.5

Species	Spring	Summer	Fall	Winter
Red-breasted merganser (*Mergus serrator*)	0.5	NA	NA	0.7
Red phalarope (*Phalaropus fulicarius*)	0.4	0.4	0.2	NA
Red-necked phalarope (*Phalaropus lobatus*)	0.3	0.3	0.2	NA
Roseate tern (*Sterna dougallii*)	0.6	0.0	0.5	NA
Royal tern (*Thalasseus maximus*)	0.0	0.2	0.1	NA
Red-throated loon (*Gavia stellate*) [a]	1.6	NA	0.5	1.0
Sooty shearwater (*Ardenna grisea*)	0.3	0.4	0.2	NA
Sooty tern (*Onychoprion fuscatus*)	0.0	0.0	NA	NA
South polar skua (*Stercorarius maccormicki*)	NA	0.2	0.1	NA
Surf scoter (*Melanitta perspicillata*)	1.2	NA	0.4	0.5
Thick-billed murre (*Uria lomvia*)	0.1	NA	NA	0.1
Wilson's storm-petrel (*Oceanites oceanicus*)	0.2	0.9	0.2	NA
White-winged scoter (*Melanitta deglandi*)	0.7	NA	0.2	1.3

Source: Winship et al. 2018.
[a] Species used in collision risk modeling.
[b] Species considered Birds of Conservation Concern by the USFWS (USFWS 2021a).
NA = not applicable.

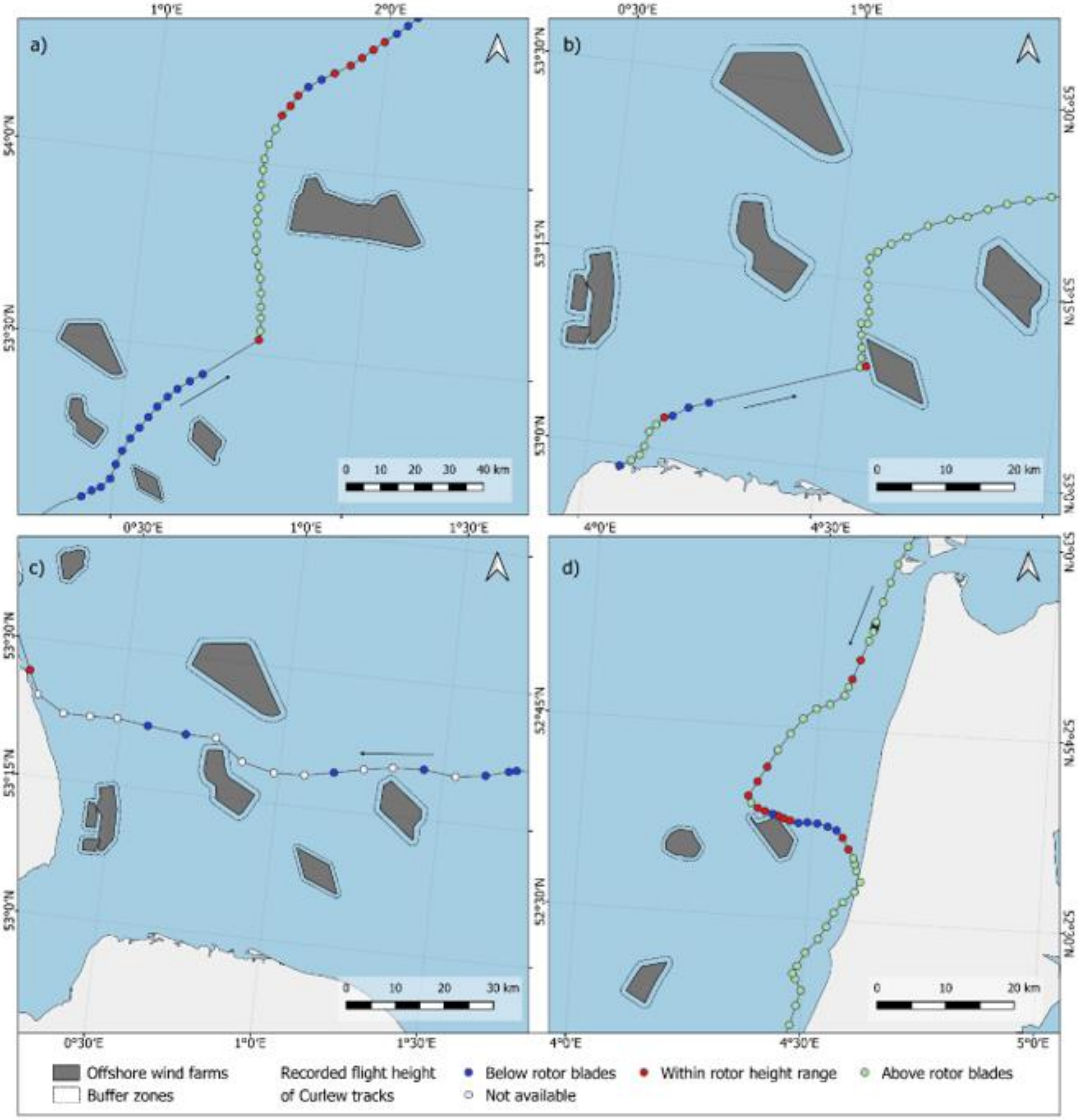
Vattenfall (a European energy company) recently studied bird movements within an offshore wind farm situated 1.9–3 miles (3–4.9 kilometers) off the coast of Aberdeen, Scotland (Vattenfall 2023). The purpose of the study was to improve the understanding of seabird flight behavior inside an offshore wind farm with a focus on the bird breeding period and post-breeding period when densities are highest. The study was robust in that seabirds were tracked inside the array with video cameras and radar tracks, which allowed for measuring avoidance movements (meso- and micro-avoidance) with high confidence and at the species level. Detailed statistical analyses of the seabird flight data were enabled both by the large sample sizes and by the high temporal resolution in the combined radar track and video camera data. Meso-avoidance behavior showed that species avoided the RSZ by flying in between the turbines with very few avoiding by changing their flight altitude to fly either below or above the rotors. The most frequently recorded adjustment under micro-avoidance behavior was birds flying along the plane of the rotor; other adjustments included crossing the rotor either obliquely or perpendicularly, and some birds cross the rotor-swept area without making any adjustments to the spinning rotors. The study concluded that, together with the recorded high levels of micro-avoidance in all species (above 0.96), it is now evident that seabirds would be exposed to very low risks of collision in offshore wind farms during daylight hours. This was substantiated by the fact that no collisions or even narrow escapes were recorded in over 10,000 bird videos during the 2 years of monitoring covering the April–October period. The study's calculated micro-avoidance rate (above 0.96) is similar to Skov et al. (2018). Further evidence supporting turbine avoidance can be found in Schwemmer and others (2023), in which 70 percent of approaching 143 GPS-tracked Eurasian curlews (*Numenius arquata arquata*) demonstrated horizontal avoidance responses when approaching offshore wind farms in the Baltic and North Seas. While most curlews avoided entire wind farms, others changed their flight altitude to fly below or above the rotor-swept zone as they pass through the wind farm (Figures 3.5.3-3, 3.5.3-4, and 3.5.3-5). Given that curlews and red knots are in the same family (Scolopacidae) and are ecologically similar, it is reasonable to expect that red knots would behave similarly to curlews when encountering wind farms and turbines.



Source: Schwemmer et al. 2023: Figure S2.

Note: Four examples of curlews approaching WTAs that show avoidance in the vertical plane by increasing flight altitudes: a) WTA London Array (UK; rotor level: 27–147 meters); b) WTA Galloper and Greater Gabbard (UK; mean rotor level: 26.1–145.9 meters); c) WTA London Array (UK; rotor level 27–147 meters); d) WTA Alpha Ventus, Borkum Riffgrund 1, Borkum Riffgrund 2 Merkur, Triane Windpark, Borkum I and Trianel Windpark Borkum II (Germany; mean rotor level: 27.3–166.2 meters). Different colors of GPS fixes represent different flight altitudes.

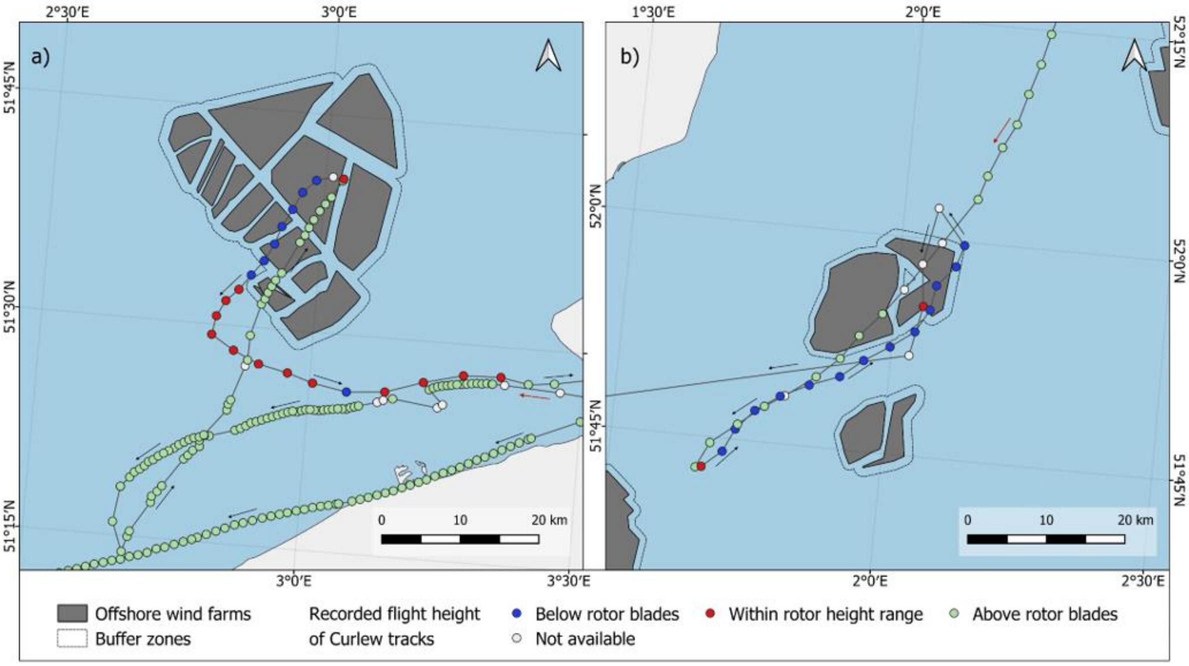
Figure 3.5.3-3. Four examples of curlews approach WTGs that show avoidance in the vertical plane by increasing flight altitudes



Source: Schwemmer et al. 2023: Figure S3.

Note: Four examples of curlews approaching WTAs that show avoidance in the horizontal plane by changing flight directions: a) WTA Hornsea Project One (United Kingdom; rotor level: 36–190 meters); b) WTA Sheringham Shoal (United Kingdom; rotor level: 26.5–133.5 meters); c) WTA Race Bank (United Kingdom; rotor level 23–177 meters); d) WTA Egmond aan Zee (the Netherlands; rotor level: 25–115 meters). Different colors of GPS fixes represent different flight altitudes.

Figure 3.5.3-4. Four examples of curlews approaching WTAs that show avoidance in the horizontal plane by changing flight directions



Source: Schwemmer et al. 2023: Figure S4.
Note: Left panel: WTA cluster belonging to Belgium and the Netherlands. The bird entered the North Sea approaching from the Netherlands, performed a loop in the south, entered the WTA cluster and returned to a roost in the Netherlands where it stayed for 9 days before continuing its journey in a straight track. Right panel: WTA Galloper and Greater Gabbard belonging to the United Kingdom. The bird entered from the north, crossed the WTA cluster performed a circle in the south, entered the WTA cluster again, performed another circle in the north, entered the WTA cluster for a third time and left the area toward the southwest. Arrows depict flight directions.

Figure 3.5.3-5. Non-directional flights within or in the vicinity of two WTAs made by two curlews tagged as breeding in north Germany

The greatest risk to birds associated with offshore wind development would be collision with operating WTGs. Offshore wind development would add up to 2,884 WTGs in the bird geographic analysis area. In the contiguous United States, bird collisions with operating WTGs are relatively rare events, with an estimated 140,000 to 500,000 (mean = 320,000) birds killed annually from about 49,000 onshore wind turbines in 39 states (USFWS 2018). Bird collisions with turbines in the eastern United States is estimated at 6.86 birds per turbine per year (USFWS 2018). Based on this mortality rate, an estimated 19,784 birds could be killed annually from the 2,884 WTGs that would be added for offshore wind development. This represents a worst-case scenario and does not consider mitigating factors, such as landscape and weather patterns, or bird species that are expected to occur. Given that the relative density of birds in the OCS is low, relatively few birds are likely to encounter WTGs (Figure 3.5.3-2). Potential annual bird kills from WTGs would be relatively low compared to other causes of migratory bird deaths in the United States; feral cats are the primary cause of migratory bird deaths in the United States (2.4 billion per year), followed by collisions with building glass (599 million per year), collisions with vehicles (214.5 million per year), poison (72 million per year), collisions with electrical lines (25.5 million per year), collisions with communication towers (6.6 million per year), and electrocutions (5.6 million per year) (USFWS 2021b). Not all individuals that occur or migrate along the Atlantic Coast are expected to encounter the RSZ of one or more operating WTGs associated with offshore wind development. Generally, only a small percentage of a species' seasonal population would potentially encounter operating WTGs (Table 3.5.3-2). The addition of WTGs to the offshore environment may result in increased functional loss of habitat for those species with higher displacement sensitivity. However, a recent study of long-term data collected in the North Sea found that despite the extensive observed displacement of loons in response to the development of 20 wind farms, there was no decline in the region's loon population (Vilela et al. 2021). Furthermore, substantial foraging habitat for resident birds would remain available outside of the proposed offshore lease areas. Impacts on birds due to the presence of operating WTGs would likely be minor; however, no individual fitness or population-level impacts would be expected to occur.

Because most structures would be spaced 0.6 to 1 nautical mile (1.1 to 1.9 kilometers) apart, ample space between WTGs should allow birds that are not flying above WTGs to fly through individual lease areas without changing course or to make minor course corrections to avoid operating WTGs. The effects of offshore wind farms on bird movement ultimately depend on the bird species, size of the offshore wind farm, spacing of the turbines, and extent of extra energy cost incurred by the displacement of flying birds (relative to normal flight costs pre-construction) and their ability to compensate for this degree of added energy expenditure. Little quantitative information is available on how offshore wind farms may act as a barrier to movement, but Madsen et al. (2012) modeled bird movement through offshore wind farms using bird (common eider) movement data collected at the Nysted offshore wind farm in the western Baltic Sea just south of Denmark. After running several hundred thousand simulations for different layouts/configurations for a 100 WTG offshore wind farm, the proportion of birds traveling between turbines increased as distance between turbines increased. With eight WTG columns at 200 meter (0.1 nm) spacing, no birds passed between the turbines. However, increasing inter-turbine distance to 500 meters (0.27 nm) increases the percentage of birds to more than 20 percent, while a spacing of 1,000 meters (0.54 nm) increased this further to 99 percent. The 0.6 to 1 nm spacing estimated for most structures that will be proposed on the Atlantic OCS is greater than the distance at which 99 percent of the birds passed through in the model. As such, adverse impacts of additional energy expenditure due to minor course corrections or complete avoidance of offshore wind lease areas would not be expected to be biologically significant. Any additional flight distances would likely be small for most migrating birds when compared with the overall migratory distances traveled, and no individual fitness or population-level effects would be expected to occur.

In the Northeast and Atlantic waters, there are 2,570 seabird fatalities through interaction with commercial fishing gear each year; of those, 84 percent are with gillnets involving shearwaters/fulmars and loons (Hatch 2017). Abandoned or lost fishing nets from commercial fishing may get tangled with foundations, reducing the chance that abandoned gear would cause additional harm to birds and other wildlife if left to drift until sinking or washing ashore. A reduction in derelict fishing gear (in this case by entanglement with foundations) has a beneficial impact on bird populations (Regular et al. 2013). In contrast, the presence of structures may also lead to an increase in recreational fishing and thus expose individual birds to harm from fishing line and hooks.

The presence of new structures could result in increased prey items for some marine bird species. Offshore wind foundations could increase the mixing of surface waters and deepen the thermocline, possibly increasing pelagic productivity in local areas (English et al. 2017; Dorrell et al. 2022). Additionally, the new structures may create habitat for structure-oriented and hard-bottom species. This reef effect has been observed around WTGs, leading to local increases in biomass and diversity (Causon and Gill 2018). Recent studies have found increased biomass for benthic fish and invertebrates, and possibly for pelagic fish, marine mammals, and birds as well (Raoux et al. 2017; Pezy et al. 2018; Wang et al. 2019), indicating that offshore wind energy facilities can generate beneficial permanent impacts on local ecosystems, translating to increased foraging opportunities for individuals of some marine bird species. BOEM anticipates that the presence of structures may result in long-term moderate beneficial impacts. Conversely, increased foraging opportunities could attract marine birds, potentially exposing those individuals to increased collision risk associated with operating WTGs.

Traffic (aircraft): General aviation traffic accounts for approximately two bird strikes per 100,000 flights (Dolbeer et al. 2019). Because aircraft flights associated with offshore wind development are expected to be minimal in comparison to baseline conditions, aircraft strikes with birds are highly unlikely to occur. As such, aircraft traffic impacts would be negligible and not expected to appreciably contribute to overall impacts on birds.

Land disturbance: Onshore construction of offshore wind development infrastructure has the potential to result in some impacts due to habitat loss or fragmentation. However, onshore construction would be expected to account for only a very small increase in development relative to other ongoing development activities. Furthermore, construction would be expected to generally occur in previously disturbed habitats, and no individual fitness- or population-level impacts on birds would be expected to occur. As such, onshore construction impacts associated with offshore wind development would be negligible and would not be expected to appreciably contribute to overall impacts on birds.

Impacts of Alternative A on ESA-Listed Species

Three bird species in the geographic analysis area are either threatened or endangered and protected by the ESA. Impacts of Alternative A on ESA-listed birds are represented in the IPF discussion under *Offshore Wind Activities*. Any future federal activities that could affect federally listed birds in the geographic analysis area would need to comply with ESA Section 7 to ensure that the proposed activities would not jeopardize the continued existence of the species.

Conclusions

Impacts of the No Action Alternative: Under the No Action Alternative, birds would continue to be affected by existing environmental trends and ongoing activities. BOEM expects ongoing activities to have continuing temporary and permanent impacts (disturbance, displacement, injury, mortality, habitat degradation, habitat conversion) on birds primarily through construction and climate change. Given that the amount of bird species that overlap with ongoing wind energy facilities on the Atlantic OCS is relatively small, ongoing wind activities would not appreciably contribute to impacts on birds. Temporary disturbance and permanent loss of habitat onshore may occur as a result of offshore wind development. However, habitat removal is anticipated to be minimal, and any impacts resulting from habitat loss or disturbance would not be expected to result in individual fitness or population-level effects in the geographic analysis area. The No Action Alternative would result in **minor adverse** impacts on birds.

Cumulative Impacts of the No Action Alternative: Under the No Action Alternative, existing environmental trends and ongoing activities would continue, and birds would continue to be affected by natural and human-caused IPFs. Planned activities would contribute to the impacts on birds due to habitat loss from increased onshore construction and interactions with offshore developments.

BOEM anticipates that the impacts associated with offshore wind activities in the geographic analysis area would result in adverse impacts but could potentially include beneficial impacts because of the presence of structures. The majority of offshore structures in the geographic analysis area would be attributable to the offshore wind development. Migratory birds that use the offshore wind lease areas during all or parts of the year would either be exposed to new collision risk or experience long-term functional habitat loss due to behavioral avoidance and displacement from wind lease areas on the OCS. The offshore wind development would also be responsible for the majority of impacts related to new cable emplacement and pile-driving noise, but effects on birds resulting from these IPFs would be localized and temporary and would not be expected to be biologically significant.

BOEM anticipates that the cumulative impacts of the No Action Alternative, which would result primarily from collision risk and functional habitat loss, would have a **moderate adverse** impact on birds because impacts, though unavoidable, would not result in population-level effects. The No Action Alternative could also include beneficial impacts on marine birds due to the presence of offshore structures; however, these impacts would be **minor beneficial** because although they would have some measurable effects on one or a few individuals or habitat, they would be localized to small areas.

3.5.3.4 Relevant Design Parameters and Potential Variances in Impacts

This EIS analyzes the maximum-case scenario; any potential variances in the proposed Project build-out as defined in the PDE would result in impacts similar to or less than described in the sections below. The following proposed PDE parameters (Appendix C, *Project Design Envelope and Maximum-Case Scenario*) would influence the magnitude of the impacts on birds.

- The onshore substation/converter stations, which could require limited tree clearing.
- The number, size, and location of the WTGs.
- The routing variants within the selected onshore export cable system, which could require removal of trees on the edge of the construction corridor.
- The time of year during which construction occurs.

Variability of the proposed Project design exists as outlined in Appendix C. Below is a summary of potential variances in impacts.

- WTG number, size, and location: the level of hazard related to WTGs is proportional to the number of WTGs installed; fewer WTGs would present less hazard to birds.
- Onshore export cable routes and substation/converter stations footprints: the route chosen (including variants within the general route) and substation/converter stations footprint would determine the amount of habitat affected.
- Season of construction: The activity and distribution of birds exhibit distinct seasonal changes. For instance, summer and fall months (generally May through October) constitute the most active season for birds in the Project area, and the months on either side coincide with major migration events. Therefore, construction during months in which birds are not present, not breeding, or less active would have a lesser impact on birds than construction during more active times.

SouthCoast Wind has committed to measures to minimize impacts on birds. These measures include, but are not limited to, siting the proposed Project to avoid locating Project components in or near areas of known important or high bird use, incorporating the use of HDD at landfall locations to avoid disturbance to shorelines and coastal habitats, using lighting technology to minimize impacts on avian species, ensuring that lighting on WTGs will be executed in accordance with FAA regulations, and developing and implementing a Post-Construction Monitoring Plan to evaluate and mitigate for potential collision risk for bird species (Appendix G, *Mitigation and Monitoring*). SouthCoast Wind's *Draft Post-Construction Avian and Bat Monitoring Framework* is provided as Attachment G-3 in Appendix G.

3.5.3.5 Impacts of Alternative B – Proposed Action on Birds

The following summarizes the potential impacts of the Proposed Action on birds during construction, O&M, and decommissioning phases (described in Chapter 2, *Alternatives)*.

Accidental releases: Some potential exists for mortality, decreased fitness, and health effects due to the accidental release of fuel, hazardous materials, and trash and debris from vessels associated with the Proposed Action. Vessels associated with the Proposed Action may potentially generate operational waste, including bilge and ballast water, sanitary and domestic wastes, and trash and debris. All vessels associated with the Proposed Action would comply with USCG requirements for the prevention and control of oil and fuel spills. Proper vessel regulations and operating procedures would minimize effects on offshore bird species resulting from the release of debris, fuel, hazardous materials, or waste (BOEM 2012). In addition, SouthCoast Wind will abide by the Bureau of Safety and Environmental Enforcement's regulations (30 CFR 250.300) concerning marine pollution prevention and control in OCS waters. In the case of an accidental spill within the proposed Project area, SouthCoast Wind will use an approved OSRP mitigation measures to prevent birds from going to affected areas including hazing, chumming, and relocating to unaffected areas (COP Volume 2, Table 16-1; SouthCoast Wind 2024). These releases, if any, would occur infrequently at discrete locations and vary widely in space and time; as such, BOEM expects localized and temporary and negligible impacts on birds.

Light: Under the Proposed Action, up to 149 WTG/OSP positions in the OCS would be lit with navigational and FAA hazard lighting; these lights have some potential to attract birds and result in increased collision risk (Hüppop et al. 2006). Birds may be less attracted to longer-wavelength lighting such as red and yellow lights (Zhao et al. 2020; Rebke et al. 2019) and steady burning lights pose a higher risk than pulsing strobe lights (Rebke et al. 2019; Patterson 2012; Kerlinger et al. 2010). In accordance with BOEM (2021) lighting guidelines and as outlined in SouthCoast Wind COP Volume 1, Section 3.3.12 (SouthCoast Wind 2024), each WTG and OSP would be lit and marked in accordance with FAA and USCG lighting standards and consistent with BOEM best practices. Lighting would be placed on all structures and would be visible throughout a 360-degree arc from the surface of the water. SouthCoast Wind would implement an ADLS to only activate WTG lighting when aircraft enter a predefined airspace. The short-duration synchronized flashing of the ADLS would have less impact on birds at night than the standard continuous, medium-intensity red strobe light aircraft warning systems. ADLS for the Proposed Action is anticipated to be activated for less than 5 hours per year, or 0.1 percent of nighttime hours, compared to standard continuous FAA hazard lighting (COP, Appendix T, Section 5.1.3; SouthCoast Wind 2024). This would reduce impacts already associated with WTG lighting. Vessel lights during construction, O&M, and decommissioning would be minimal and likely limited to vessels transiting to and from construction areas. To further reduce impacts on birds, SouthCoast Wind proposes to minimize lighting, to the extent practicable. As such, BOEM expects impacts, if any, to be long term but negligible from lighting.

Cable emplacement and maintenance: The Proposed Action would disturb up to 3,888 acres (1,573 hectares) of seafloor associated with the installation of interarray cable and offshore cable, which would result in turbidity effects that have the potential to reduce marine bird foraging success or have temporary and localized impacts on marine bird prey species including the sand lance (*Ammodytes* sp.; Staudinger et al. 2020). These impacts are expected to be temporary, with sediments settling quickly to the seabed and potential plumes generally confined to just above the seabed. The maximum TSS level would drop below 10 mg/l (0.00008 lb/gal) within 2 hours for all simulated scenarios and drop below 1 mg/l (0.000008 lb/gal) within 4 hours for any scenario except for nearshore areas of the Brayton Point corridor where 100 mg/L and 10 mg/L concentrations would last for less than 5 hours and a little over 2 days, respectively (SouthCoast Wind 2024). Dredging, which may also occur along the proposed cable routes in locations where sand waves (naturally mobile slopes on the seabed) are encountered or when crossing federal and state navigation channels, would produce similar effects, but with plumes likely to last longer and extend farther out. As BOEM (2018) notes, while turbidity would likely be high in the areas affected by dredging, the sediment would not affect water quality after it settles, and the period of sediment suspension would be very short term and localized. Individual birds would be expected to successfully forage in nearby areas not affected by increased sedimentation during cable emplacement, and only non-measurable negligible impacts, if any, on individuals or populations would be expected given the localized and temporary nature of the potential impacts.

Noise: The expected impacts of aircraft, G&G surveys, and pile-driving noise associated with Proposed Action alone would not increase the impacts of noise beyond those described under the No Action Alternative. Effects on offshore bird species could occur during the construction phase of the Proposed

Action due to equipment noise, primarily through sound generated from pile driving. The pile-driving noise impacts would be short term (2 hours per pin pile with a maximum of eight per day or 4 hours per monopile with a maximum of two per day) and soft starts will be used to mitigate impacts (COP Volume 2, Table 9-11; SouthCoast Wind 2024). Additionally, prey species for marine birds would likely be temporarily displaced from the active construction noise, which would likely cause avian species to forage elsewhere. Potential disturbances from pile-driving noise are expected to be temporary and limited to the areas where the activity occurs.

Vessel and construction noise from seabed preparation, substructure installation, WTG and OSP installation, cable laying, and placement of scour protection could disturb offshore bird species, but they would likely acclimate to the noise or move away, potentially resulting in a temporary loss of habitat (BOEM 2012). During construction, multiple vessels may operate concurrently throughout the Lease Area or offshore export cable corridor with dynamic positioning vessels generating noise from cavitation on the propeller blades of the thrusters. However, marine life, including diving birds, within the region is regularly subjected to vessel activity and would be habituated to the underwater noise (BOEM 2014b). BOEM anticipates the temporary impacts, if any, related to construction and installation of the offshore components would be negligible.

Normal operation of the substation and/or converter stations would generate continuous noise, but BOEM expects negligible long-term impacts when considered in the context of the other commercial and industrial noises near the proposed sites. Noise from onshore construction would be mitigated to the extent practicable and is also considered negligible in context of other short-term commercial and industrial noises near the proposed substation.

Presence of structures: The various types of impacts on birds that could result from the presence of structures, such as fish aggregation and associated increase in foraging opportunities, entanglement and fishing gear loss or damage, migration disturbances, and WTG strikes and displacement, are described in detail Section 3.5.3.3, *Impacts of Alternative*. The impacts of the Proposed Action alone as a result of presence of structures would be long term but minor and may include some minor beneficial impacts.

As previously described and depicted for the offshore wind lease areas on Figure 3.5.3-6 and Figure 3.5.3-7, the locations of the OCS offshore wind lease areas were selected to minimize impacts on all resources, including birds. Within the Atlantic Flyway along the North American Atlantic Coast, much of the bird activity is concentrated along the coastline (Watts 2010). Waterbirds use a corridor between the coast and several kilometers out onto the OCS, while land birds tend to use a wider corridor extending from the coastline to tens of kilometers inland (Watts 2010). However, operation of the Proposed Action would result in impacts on some individuals of offshore bird species and possibly some individuals of coastal and inland bird species during spring and fall migration. These impacts could arise through direct mortality from collisions with WTGs or through behavioral avoidance and habitat loss (Drewitt and Langston 2006; Fox et al. 2006; Goodale and Millman 2016). The predicted activity of bird populations that have a higher sensitivity to collision (as defined by Robinson Willmott et al. 2013) is relatively low in the OCS during all seasons of the year (Figure 3.5.3-6), suggesting that bird fatalities due to collision are likely to be low.

When WTGs are present, many birds would avoid the WTG site altogether, especially the species that ranked "high" in vulnerability to displacement by offshore wind energy development (Robinson Willmott et al. 2013). In addition, many birds would likely adjust their flight paths to avoid WTGs by flying above, below, or between them (e.g., Desholm and Kahlert 2005; Plonczikier and Simms 2012; Skov et al. 2018). Several species have very high avoidance rates; for example, the northern gannet, black-legged kittiwake, herring gull, and great black-backed gull have measured avoidance rates of at least 99.6 percent (Skov et al. 2018). Vattenfall (a European energy company) recently studied bird movements within an offshore wind farm situated 1.8–3 miles (3–4.9 kilometers) off the coast of Aberdeen, Scotland (Vattenfall 2023). The purpose of the study was to improve the understanding of seabird flight behavior inside an offshore wind farm with a focus on the bird breeding period and post-breeding period when densities are highest. The study was robust in that seabirds were tracked inside the array with video cameras and radar tracks, which allowed for measuring avoidance movements (meso- and micro-avoidance)[1] with high confidence and at the species level. Detailed statistical analyses of the seabird flight data were enabled both by the large sample sizes and by the high temporal resolution in the combined radar track and video camera data. Meso-avoidance behavior showed that species avoided the RSZ by flying in between the turbines with very few avoiding by changing their flight altitude in order to fly either below or above the rotors. The most frequently recorded adjustment under micro-avoidance behavior was birds flying along the plane of the rotor; other adjustments included crossing the rotor either obliquely or perpendicularly, and some birds cross the rotor-swept area without making any adjustments to the spinning rotors. The study concluded that, together with the recorded high levels of micro-avoidance in all species (over 0.96), it is now evident that seabirds will be exposed to very low risks of collision in offshore wind farms during daylight hours. This was substantiated by the fact that no collisions or even narrow escapes were recorded in over 10,000 bird videos during the 2 years of monitoring covering the April–October period. The study's calculated micro-avoidance rate (over 0.96) is similar to Skov et al. (2018).

[1] Micro-avoidance is flight behavior within and in the immediate vicinity of individual wind turbine rotor swept areas (i.e., last second action to avoid collision); meso-avoidance is flight behavior within and in the immediate vicinity of the wind farm (i.e., anticipatory/impulsive evasion of rows of turbines in a wind farm).

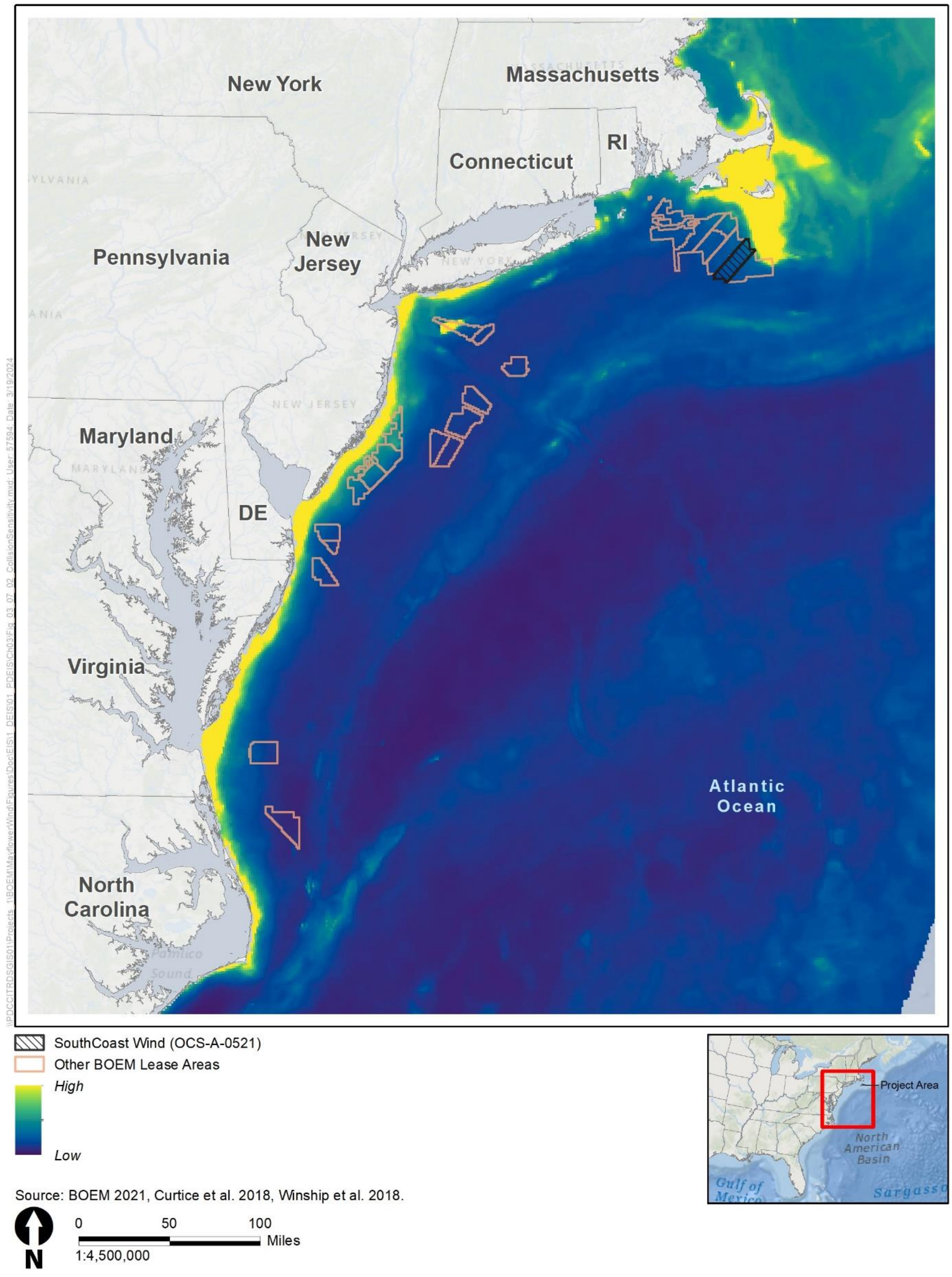


Figure 3.5.3-6. Total avian relative abundance distribution map for the higher collision sensitivity species group

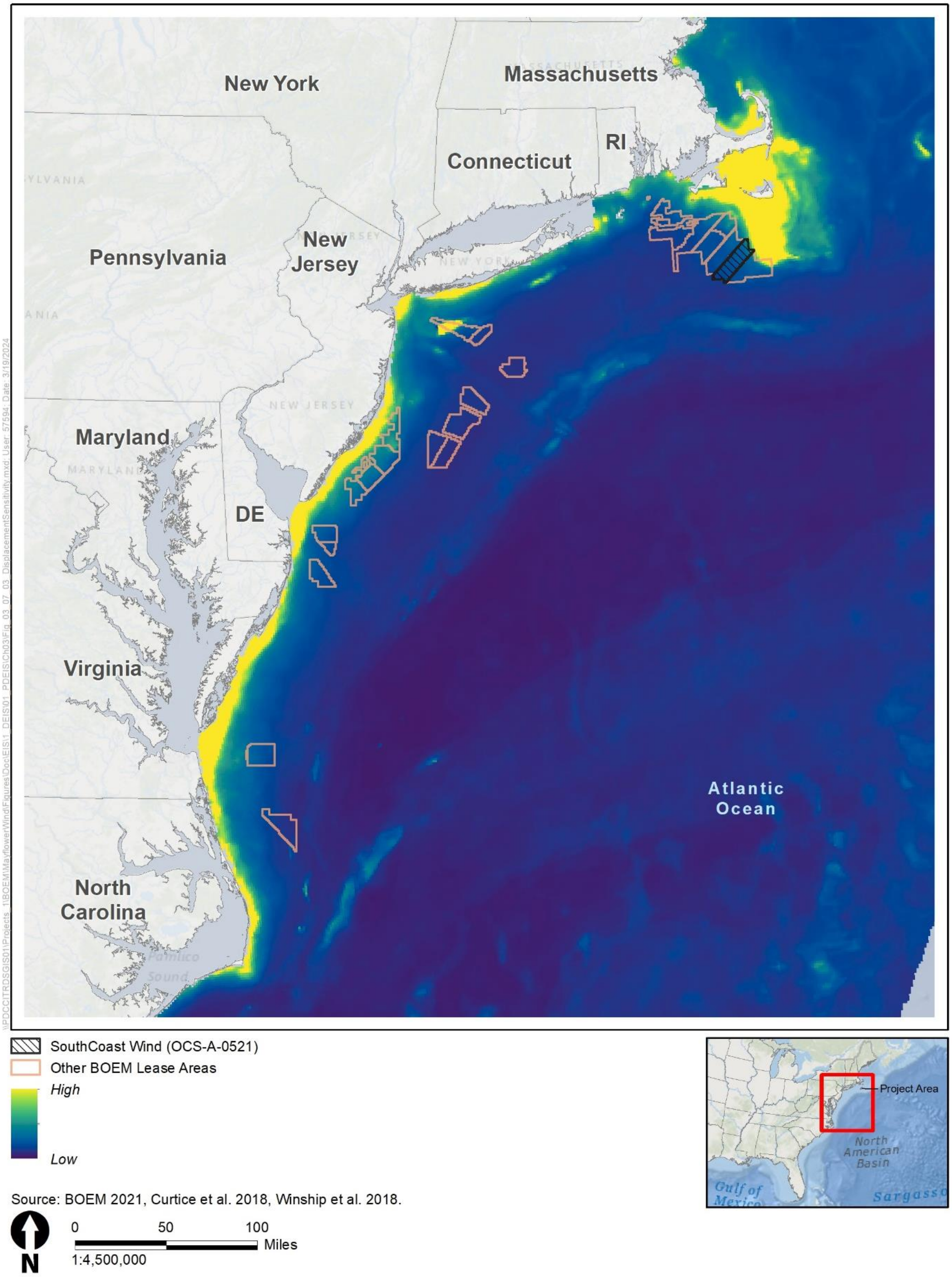


Figure 3.5.3-7. Total avian relative abundance distribution map for the higher displacement sensitivity species group

SouthCoast Wind performed an avian exposure risk assessment to estimate the risk of various offshore bird species encountering the Wind Farm Area (SouthCoast Wind 2024). The Lease Area is not likely to contain areas where high relative abundances of collision risk species may collide with the operational turbines. However, some collision-sensitive species—including the razorbill, northern gannet, gull, and seaducks—may frequent northern portions of the Lease Area during the winter and spring. Displacement-sensitive species densities including the razorbill, northern gannet and some seaduck species are likely to be low relative to regional and local waters with a small pocket of the moderately high activity recorded in the northern portion of the Lease Area during the winter and spring. While some non-marine birds have the potential to be exposed to the Wind Farm Area, it is far enough offshore as to be beyond the range of most breeding terrestrial or coastal bird species. Of the species considered to have a higher overall exposure risk, the northern gannet and long-tailed duck are listed as SGCNs in Massachusetts; the razorbill, black scoter, red-breasted merganser, and surf scoter are listed as SGCNs in Rhode Island; and the common eider is listed as an SGCN in both Massachusetts and Rhode Island.

During migration, many bird species, including songbirds, likely fly at heights well above or below the RSZ (75.5 to 1,066.4 feet [23 to 325 meters] above MLLW) (COP Appendix I1; SouthCoast Wind 2024). As shown in Robinson Willmott et al. (2013), species with low sensitivity scores include many passerines that only cross the Atlantic OCS briefly during migration and typically fly well above the RSZ. Other bird species such as seaducks have been observed increasing their altitude to avoid WTGs during the night (Desholm and Kahlert 2005). However, bird species such as gulls are ranked as vulnerable to collisions as they fly at RSZ heights (Johnston et al. 2014; Cook et al. 2012) but may exhibit avoidance behavior (Cook et al. 2012).

It is generally assumed that inclement weather and reduced visibility cause changes to migration altitudes (Ainley et al. 2015) and could potentially lead to large-scale mortality events. However, this has not been shown to be the case in studies of offshore wind facilities in Europe, with oversea migration completely, or nearly so, ceasing during inclement weather (Fox et al. 2006; Pettersson 2005; Hüppop et al. 2006), and with migrating birds avoiding flying through fog and low clouds (Panuccio et al. 2019). Furthermore, many of these passerine species, while detected on the OCS during migration as part of BOEM's Acoustic/Thermographic Offshore Monitoring project (Robinson Willmott and Forcey 2014), were documented in relatively low numbers. While several studies documenting bird flight and wind speeds over terrestrial environments have shown birds to fly at variable wind speeds, including above the typical cut-in speeds of wind turbines (Abdulle and Fraser 2018; Bloch and Bruderer 1982; Bruderer and Boldt 2001; Chapman et al. 2016), Robinson Willmott and Forcey (2014) found that most of the bird activity (including blackpoll warblers) in the offshore environment on the OCS occurred during windspeeds less than 6 miles per hour (10 kilometers per hour) (Robinson Willmott and Forcey 2014: Figure 109). The cut-in speed for the SouthCoast Wind WTGs is 5.6 to 8.9 miles per hour (9 to 14.4 kilometers per hour); therefore, based on the Robinson Willmott and Forcey (2014) offshore study, passerines would likely be migrating when the turbine blades are more often idle. Furthermore, most carcasses of small migratory songbirds found at land-based wind energy facilities in the Northeast were within 6.6 feet (2 meters) of the turbine towers, suggesting that they are colliding with towers rather than with moving turbine blades (Choi et al. 2020). Although it is possible that migrating passerines could collide with offshore structures, migrating passerines are also occasionally found dead on boats, presumably from exhaustion (e.g., Stabile et al. 2017).

Some marine bird species might avoid the Wind Farm Area during its operation, leading to an effective loss of habitat. For example, loons (Dierschke et al. 2016; Drewitt and Langston 2006; Lindeboom et al. 2011; Percival 2010; Petersen et al. 2006), grebes (Dierschke et al. 2016; Leopold et al. 2011, 2013), seaducks (Drewitt and Langston 2006; Petersen et al. 2006), and northern gannets (Drewitt and Langston 2006; Lindeboom et al. 2011; Petersen et al. 2006) typically avoid offshore wind developments. The proposed Project would no longer provide foraging opportunities to those species with high displacement sensitivity, but suitable foraging habitat exists in the immediate vicinity of the proposed Project and throughout the region. However, as depicted on Figure 3.5.3-7, modeled use of the Wind Farm Area by bird species with high displacement sensitivity is low. A complete list of species included in the higher displacement sensitivity group can be found in Robinson Willmott et al. (2013). Because the Wind Farm Area is not likely to contain important foraging habitat for the species susceptible to displacement, BOEM expects this loss of habitat to be insignificant. SouthCoast Wind proposes to develop and implement a Post-Construction Monitoring Plan to evaluate and mitigate for potential collision risk for bird species (COP Volume 2, Table 16-1; SouthCoast Wind 2024); SouthCoast Wind's *Draft Post-Construction Avian and Bat Monitoring Framework* is provided in Appendix G, *Mitigation and Monitoring*. Population-level, long-term impacts resulting from habitat loss would likely be negligible.

Generally, onshore operation is not expected to pose any significant IPFs (i.e., hazards) to birds because activities would disturb little if any habitat. The Onshore Project components are mostly within existing, highly disturbed, industrial areas that are unlikely to provide important bird habitat.

Traffic (aircraft): The expected impacts of aircraft traffic associated with the Proposed Action would be negligible and would not increase impacts beyond those described for the No Action Alternative.

Land disturbance: The expected impacts of onshore construction associated with the Proposed Action would not increase the impacts of this IPF beyond those described under the No Action Alternative. SouthCoast Wind proposes to use HDD technology for cable installation at landfall locations, which will primarily go under beaches and would avoid beach habitat for nesting shorebirds (COP Volume 2, Table 16-1; SouthCoast Wind 2024); as such, temporary impacts on birds, particularly nesting shorebirds, resulting from the landfall location would be negligible. Collisions between birds and vehicles or construction equipment have limited potential to cause mortality. However, these temporary impacts, if any, would be negligible, as most individuals would avoid noisy construction areas (Bayne et al. 2008; Goodwin and Shriver 2010; McLaughlin and Kunc 2013).

Overall, impacts on bird habitat from onshore construction activities would be limited because, whenever possible, facilities (including overhead transmission lines) would be co-located with existing developed areas to limit disturbance. Vegetation clearing would likely be minimal for the sites in

Falmouth and the sites of the converter stations and Onshore Project components at Brayton Point.[2] If tree clearing is required, SouthCoast Wind has proposed to conduct habitat assessments and presence/absence surveys and would coordinate with MassWildlife, RIDEM, and USFWS as appropriate. Clearing during construction within temporary workspaces would result in temporary loss of forage and cover for birds within the area. Construction of the onshore converter stations and/or substation would result in temporary and permanent impacts on habitat from construction of the permanent converter station/substation facility and use of temporary construction workspace. However, the existing habitat at the sites of the onshore converter stations and substation sites is in previously disturbed areas and the Project would result in no further additional habitat fragmentation, significant new open spaces, or open corridors (SouthCoast Wind 2024). Due to the short duration of the activities and AMMs (COP Volume 2, Table 16-1; SouthCoast Wind 2024) that SouthCoast Wind has committed to implementing to reduce impacts, population-level impacts on birds from habitat modification and impacts are unlikely. Given the nature of the existing habitat, its abundance on the landscape, and the temporary nature of construction, the impacts on birds are expected to be negligible.

Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned non-offshore wind and offshore wind activities. Ongoing and planned non-offshore wind activities related to installation of new submarine cables and pipelines, increasing onshore construction, marine minerals extraction, port expansions, and installation of new structures would contribute to impacts on birds through the primary IPFs of accidental releases, lighting, cable emplacement and maintenance, presence of structures, traffic (aircraft), and land disturbance. The construction, O&M, and decommissioning of both onshore and offshore infrastructure for offshore wind activities across the geographic analysis area would also contribute to the same IPFs. Given that the abundance of bird species that overlap with wind energy facilities on the Atlantic OCS is relatively small, offshore wind activities would not appreciably contribute to impacts on bird populations. Temporary disturbance and permanent loss of habitat onshore may occur as a result of offshore wind development. However, habitat removal is anticipated to be minimal, and any impacts resulting from habitat loss or disturbance would not be expected to result in individual fitness or population-level effects within the geographic analysis area. Ongoing and planned offshore wind activities in combination with the Proposed Action would result in an estimated 3,031 WTGs, of which the Proposed Action would contribute 147 or about 5 percent.

The cumulative impacts on birds would likely be moderate because, although bird abundance on the OCS is low, there could be unavoidable impacts offshore and onshore; however, BOEM does not anticipate the impacts to result in population-level effects or threaten overall habitat function. In the

[2] As described in Chapter 2, Section 2.1.2, *Alternative B – Proposed Action*, Brayton Point is the preferred POI for both Project 1 and Project 2, and Falmouth is the variant POI for Project 2, which would be used if SouthCoast Wind is prevented from using Brayton Point for Project 2.

context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the cumulative impacts on birds.

Impacts of Alternative B on ESA-Listed Species

Three bird species in the geographic analysis area are either threatened or endangered and protected by ESA. Impacts of the Proposed Action on ESA-listed birds are represented in the IPFs discussed previously as all impact types and mechanisms for birds also apply to ESA-listed birds. BOEM prepared a BA analyzing the effects of the Project on USFWS federally listed species. There are no critical habitats designated for these species in the action area defined in the BA. Consultation with USFWS pursuant to Section 7 of the ESA concluded on September 1, 2023, and results of the consultation are included in the *Conclusions* section below.

Conclusions

Impacts of the Proposed Action: Construction, installation, O&M, and eventual decommissioning of the Proposed Action would have **minor adverse** impacts on birds, depending on the location, timing, and species affected by an activity. The primary factors of the Proposed Action affecting birds are habitat loss and collision-induced mortality from rotating WTGs and permanent habitat loss and conversion from onshore construction. The Proposed Action would also result in potential **minor beneficial** impacts associated with foraging opportunities for marine birds.

BOEM prepared a BA assessing the potential effects on federally listed species (BOEM 2023). Consultation with USFWS pursuant to Section 7 of the ESA was concluded September 1, 2023. In USFWS's transmittal letter for the Biological Opinion, USFWS concurred with BOEM's determination of it may affect, but is not likely to adversely affect, for the roseate tern. For the piping plover and rufa red knot, USFWS issued a Biological Opinion on BOEM's determination of likely to adversely affect (USFWS 2023). The Biological Opinion stated that USFWS does not anticipate significant reduction in the reproduction, numbers, or distribution of the piping plover and rufa red knot. USFWS conservation measures, other Project measures, and nondiscretionary terms and conditions included in the Biological Opinion to minimize or compensate for Project effects related to collision risk or to address significant data gaps in avian and bat use of offshore areas, collision modeling, and compensatory mitigation are presented in Table G-2 (Appendix G). With the adoption of these measures, it is USFWS's conclusion that operation of the SouthCoast Wind Project is not likely to jeopardize the continued existence of the Atlantic Coast piping plover or the rufa red knot (USFWS 2023).

Cumulative Impacts of the Proposed Action: BOEM anticipates that the cumulative impacts from the Proposed Action on birds in the geographic analysis area, primarily due to collision risk and functional habitat loss, would be **moderate adverse** because impacts would be unavoidable, but not result in population-level effects. The Proposed Action could also include cumulative beneficial impacts on marine birds due to the presence of offshore structures; however, these impacts would only be **minor beneficial** because although they would have some measurable effects on one or a few individuals or habitat, they would be localized to a small area. The contribution of the Proposed Action to the cumulative impacts of individual IPFs resulting from ongoing and planned activities would range from negligible to moderate, as well as moderate beneficial impacts. The Proposed Action would contribute to the cumulative impacts primarily through the permanent impacts from the presence of structures.

3.5.3.6 Impacts of Alternative C on Birds

Impacts of Alternative C: Under Alternative C, the export cable route to Brayton Point would be rerouted onshore to avoid sensitive fish habitat in the Sakonnet River. The new overland portions of Alternative C-1 and Alternative C-2 would largely be sited in public road ROWs to the extent possible. Both the eastern and western variations of Alternative C-1 and Alternative C-2 overlap four separate Natural Heritage areas. Prior to traveling along Route 138, the eastern variation additionally abuts Gardiner Pond, the Heffenreffer Wildlife Refuge, and the Norman Bird Sanctuary and would be 1 mile (1.7 kilometers) northwest of the Sachuest Point National Wildlife Refuge (NWR). Both the Norman Bird Sanctuary and the Sachuest Point NWR provide stopover and wintering habitat that support federally and state-listed migratory birds.

Alternative C-1 would increase the total onshore export cable route by 9 miles (14 kilometers) over the Proposed Action. The increase of land disturbance would require a longer construction schedule due to the complexity of working in developed areas with multiple property owners along the proposed route. Additionally, Alternative C-1 passes through coastal communities that are popular tourist destinations in the summer months which may lead to seasonal limitations on construction. The combination of a slower rate of progress and seasonal restrictions would result in a significantly longer construction period for onshore cable runs.

The only IPFs that would be meaningfully different under Alternative C compared to the Proposed Action are land disturbance and new cable emplacement/maintenance. The primary impacts of Alternative C affecting birds would be habitat loss from tree and brushland disturbance, which would result in both temporary and permanent impacts. In addition to the forest and brushland area disturbed under the Proposed Action, 4.95 acres (2.00 hectares), 2.59 acres (1.04 hectares), and 15.46 acres (6.26 hectares) of forest habitat could be disturbed under Alternative C-1 (eastern variation), Alternative C-1 (western variation), and Alternative C-2, respectively. In addition, 1.51 acres (0.61 hectare), 1.07 acres (0.43 hectare), and 1.31 acres (0.53 hectare) of brushland under Alternative C-1 (eastern variation), Alternative C-1 (western variation), and Alternative C-2, respectively, would be disturbed in addition to the Proposed Action disturbance (refer to Section 3.5.4, *Coastal Habitat and Fauna*). These impacts may affect bird foraging and nesting located along the edges of the road ROWs. While the area of tree and brushland disturbance would be greater than the Proposed Action, the potential impact on birds would remain minor.

In the aquatic environment, Alternative C-1 and Alternative C-2 would reduce the total offshore export cable route by 9 miles (14 kilometers) and 12 miles (19 kilometers), respectively. However, cable emplacement activity would still occur and result in short-term and localized sediment suspension. Individual birds would be expected to successfully forage in nearby areas and impacts would remain negligible.

Cumulative Impacts of Alternative C: In the context of reasonably foreseeable environmental trends, the cumulative impacts of Alternative C would be similar to those described under the Proposed Action.

Impacts of Alternative C on ESA-Listed Species

BOEM anticipates that SouthCoast Wind would use HDD technology for cable installation at the Alternative C-1 landfall location. Cables would be installed primarily under beaches and would avoid beach habitat for nesting shorebirds, which would include the three ESA-listed species in the Project area. As such, impacts on these species' habitat would be avoided and other construction impacts (e.g., noise) would be temporary and negligible. There is no beach habitat for the three ESA-listed bird species at the Alternative C-2 landfall.

Conclusions

Impacts of Alternative C: Impacts of Alternative C would be similar to the impacts of the Proposed Action. While Alternative C would result in a greater area of onshore habitat impacts along the onshore export cable routes than the Proposed Action, the overall affected area would be small and the same construction, O&M, and decommissioning impacts would still occur. Therefore, Alternative C would result in **minor** adverse impacts on birds and could include **minor beneficial** impacts.

Cumulative Impacts of Alternative C: In context of reasonably foreseeable environmental trends, BOEM anticipates that the cumulative impacts associated with Alternative C on birds, primarily due to habitat loss and collision risk, would be similar to the Proposed Action and result in **moderate** adverse impacts, because impacts would be unavoidable, but not result in population-level effects. Cumulative impacts would also be **minor beneficial** because although increased foraging habitat due to the presence of structures would have some measurable effects on one or a few individuals or habitat, they would be localized to a small area.

3.5.3.7 Impacts of Alternatives D (Preferred Alternative), E, and F on Birds

Impacts of Alternatives D, E, and F: Impacts on birds associated with construction and installation, O&M, and decommissioning of the Project under Alternatives D, E, and F would be similar to those described under the Proposed Action. Under Alternative D, potential impacts on birds from the presence of structures, noise, and light could be reduced with the removal of six WTGs in the northern portion of the Lease Area that are nearest to Nantucket Shoals. Nantucket Shoals provides foraging habitat for various avian species including seabirds and seaducks and has high year-round avian abundance (Figure 3.5.3-2). As shown in Chapter 2*, Alternatives*, Figure 2-7, Nantucket Shoals is a persistent hotspot of *gammarid* amphipod abundance, which is a persistent food source for seaducks, including the long-tailed duck (*Clangula hyemalis*) and potentially white-winged scoters (*Melanitta deglandi*) (White et al. 2009; Veit et al. 2016). In addition to these species, the northern portions of the Lease Area may be frequented by other collision-sensitive and displacement-sensitive species including the northern gannet, razorbill, and gull in winter and spring (Figure 3.5.3-6 and Figure 3.5.3-7), and a reduction in offshore wind development in this area may lessen the impacts on these species. The red-throated loon may also frequent the northern portion of the Lease Area. The removal of six WTGs in this area may lessen the impacts on birds by providing more area of open ocean nearest to Nantucket Shoals foraging habitat. However, this 4 percent reduction in WTGs represents only a small portion of the overall Project, and impacts associated with the remaining 141 WTGs would still occur. Overall impacts are not anticipated to be materially different than the Proposed Action.

None of the differences between Alternatives E and F and the Proposed Action would have the potential to significantly reduce or increase impacts on birds from the analyzed IPFs. Alternative E-1 would require all piled foundations, resulting in similar impacts from noise as the Proposed Action. Under Alternative E-2 and Alternative E-3, foundations would be used that require no impact pile driving (suction-bucket and GBS), eliminating impacts on diving birds due to underwater noise. Foundations with larger seabed footprints (Alternative E-3) may present increased foraging opportunities due to increased aggregations of fish near structures due to the presence of artificial reefs. BOEM anticipates that the impacts on birds under Alternatives E-1, E-2, and E-3 would not be measurably different from those anticipated under the Proposed Action. Under Alternative F, the Falmouth offshore export cable route would still be within the Proposed Action's PDE but would include only three HVDC cables compared to five HVAC cables under the Proposed Action, which would reduce seafloor disturbance by approximately 700 acres. The reduction in seafloor disturbance would not have a meaningful difference on bird foraging opportunities.

Cumulative Impacts of Alternatives D, E, and F: In the context of reasonably foreseeable environmental trends, the cumulative impacts of Alternatives D, E, and F would be similar to those described under the Proposed Action.

Impacts of Alternatives D, E, and F on ESA-Listed Species

Impacts on ESA-listed species resulting from individual IPFs associated with the construction and installation, O&M, and decommissioning of the Project under Alternatives D, E, and F would be similar to those described under the Proposed Action for the reasons described above for all birds. Coastal shorebirds including the *rufa* red knot and piping plover may travel through the Lease Area, but available data do not indicate that such movements are common. Tern species, including the roseate tern, may occur in the Lease Area in low to moderate levels relative to regional and local occurrences. Concentrations of terns are not expected in the Lease Area based on sand lance distribution data. None of the differences between Alternatives E and F and the Proposed Action would have the potential to significantly reduce or increase impacts on ESA-listed birds from the analyzed IPFs. BOEM does not anticipate impacts to be measurably different than those described under the Proposed Action.

Conclusions

Impacts of Alternatives D, E, and F: The expected **minor adverse** impacts and **minor beneficial** impacts associated with the Proposed Action alone would not change under Alternatives D, E, and F. Alternative D would reduce the number of WTGs compared to the Proposed Action in the northern Lease Area but would have similar overall impacts on birds. Alternative E would reduce impacts on diving birds due to underwater noise under Alternatives E-2 and E-3 but, along with Alternative F, would have the same

WTG number and overall Wind Farm Area footprint as the Proposed Action and, therefore, would have similar impacts on birds.

Cumulative Impacts of Alternatives D, E, and F: In context of reasonably foreseeable environmental trends, BOEM anticipates that the cumulative impacts associated with Alternatives D, E, and F on birds, primarily due to habitat loss and collision risk, would be similar to the Proposed Action and result in **moderate adverse** impacts, because impacts would be unavoidable, but not result in population-level effects. Cumulative impacts would also be **minor beneficial** because although increased foraging habitat due to the presence of structures would have some measurable effects on one or a few individuals or habitat, it would be localized to a small area.

3.5.3.8 Comparison of Alternatives

Under Alternative C, the export cable route to Brayton Point would be rerouted onshore resulting in the overlap of four separate Natural Heritage areas, which provide stopover and overwintering habitat that support federally and state-listed migratory birds. While the area of tree and brushland disturbance would be greater than that associated with the Proposed Action, the anticipated minor impacts of the Proposed Action would not change substantially under Alternative C. Therefore, the overall impact level on birds would not change—minor and minor beneficial impacts.

Alternatives D, E, or F would have the same, or fewer number of WTGs as the Proposed Action, which would result in the same impacts on birds; the overall impact level would not change—minor and minor beneficial impacts.

In the context of reasonably foreseeable environmental trends, the cumulative impacts associated with Alternatives C, D, E, and F when each is combined with the impacts from ongoing and planned activities would be the same as for the Proposed Action—minor and minor beneficial impacts.

3.5.3.9 Proposed Mitigation Measures

Additional mitigation measures identified by BOEM and cooperating agencies as a condition of state and federal permitting, or through agency-to-agency negotiations, are described in detail in Appendix G, Tables G-2 through G-4 and summarized and assessed in Table 3.5.3-4. If one or more of the measures analyzed here are adopted by BOEM or cooperating agencies, some adverse impacts on bats could be further reduced. The Draft EIS analyzed two BOEM-proposed bird and bat mitigation measures, that were subsequently incorporated into the ESA consultation and are now reflected in Appendix G, Table G-2 (i.e., adaptive mitigation for birds and bats, and annual bird and bat mortality reporting).

Table 3.5.3-4. Mitigation and Monitoring Measures Resulting from Consultations (also identified in Appendix G, Table G-2): birds

Measure	Description	Effect
Conservation Measures and Reasonable and Prudent Measures from Terms and Conditions from the USFWS Biological Opinion	USFWS Conservation Recommendations, Reasonable and Prudent Measures, and Terms and Conditions were transmitted by letter dated September 1, 2023. Conservation Recommendations under BOEM, BSEE, and USFWS jurisdiction include turbine configuration, collision risk model support and utilization, light impact reduction, Avian and Bat Post-Construction Monitoring Plan, and Incidental Mortality and Reporting. Reasonable and Prudent Measures include collision minimization and collision detection reports.	Measures required through the ESA consultation would likely result in reduced potential impacts on birds. Should post-construction monitoring show impacts on birds deviate substantially from the impact analysis in the EIS, measures would be implemented to address the specific impact reported. Potential collision impacts with offshore WTGs and OSPs could be reduced by requiring installation of bird perching-deterrent devices and shielding of light downward to minimize bird attraction to operating WTGs and on the OSP. Implementation of these measures would provide incremental reductions in impacts on birds, would improve accountability, and would reduce uncertainty associated with estimated rates of collision mortality, but would not alter the overall impact determination.

Table 3.5.3-5. BOEM or agency-proposed measures (also identified in Appendix G, Table G-3): birds

Measure	Description	Effect
Compensatory Mitigation for Piping Plover, Red Knot, and Roseate Tern	At least 180 days prior to the start of commissioning of the first WTG, the lessee must distribute a Compensatory Mitigation Plan to BOEM, BSEE, and the USFWS for review and comment. BOEM, BSEE, and USFWS will review the Compensatory Mitigation Plan and provide any comments on the plan to the lessee within 60 days of its submittal. The lessee must resolve all comments on the Compensatory Mitigation Plan to BOEM's and BSEE's satisfaction before implementing the plan and before commissioning of the first WTG. The Compensatory Mitigation Plan must provide compensatory mitigation actions to offset take of piping plover, red knot, and roseate tern for the first 5 years of WTG operation. The Compensatory Mitigation Plan must include a) detailed description of the mitigation actions; b) the specific location for each mitigation action; c) a timeline for completion of the mitigation measures; d) itemized costs for implementing the mitigation actions; e) details of the mitigation mechanisms (e.g., mitigation agreement, applicant-proposed mitigation; and f) monitoring to ensure the effectiveness of the mitigation actions in offsetting take.	While this mitigation would offset any take of ESA-listed species in the Project Area, it would not reduce the impact rating for any of the Proposed Action's IPFs.

Measures Incorporated in the Preferred Alternative

Mitigation measures required through completed consultations, authorizations, and permits listed in Table 3.5.3-4 and Table 3.5.3-4, and Tables G-2 and G-3 in Appendix G are incorporated in the Preferred Alternative. These measures would further define how the effectiveness and enforcement of environmental protection measures would be ensured and improve accountability for compliance with environmental protection measures by requiring monitoring, reporting, and adaptive management of potential bird impacts on the OCS. However, given bird use of the OCS is anticipated to be low, offshore wind activities are unlikely to appreciably contribute to impacts on birds regardless of measures intended to address potential offshore bird impacts. In the onshore environment, tree-clearing restrictions and conducting post-construction monitoring and reporting would ensure impacts on birds and their habitats would be avoided and minimized to the extent practicable. Because these measures ensure the effectiveness of and compliance with environmental protection measures that are already analyzed as part of the Proposed Action, these measures would not further reduce the impact level of the Proposed Action from what is described in Section 3.5.3.5, *Impacts of Alternative B – Proposed Action on Birds*.

3.5 Biological Resources

3.5.4 Coastal Habitat and Fauna

This section discusses potential impacts on coastal habitat and fauna resources from the Proposed Action, alternatives, and ongoing and planned activities in the coastal habitat and fauna geographic analysis area. Coastal habitat includes flora and fauna within state waters (which extend 3 nautical miles [5.6 kilometers] from the shoreline) inland to the mainland, including the foreshore, backshore, dunes, and interdunal areas. The coastal habitat and fauna geographic analysis area, as shown in Figure 3.5.4-1, includes the area within a 1.0-mile (1.6-kilometer) buffer of the Onshore Project area that includes the offshore export cable corridors, the landfall locations under consideration, the overhead transmission lines, underground transmission lines, substation, converter stations, and points of interconnection at Brayton Point, in Somerset, Massachusetts, and in Falmouth, Massachusetts. [1]

This section analyzes the affected environment and environmental consequences of the Proposed Action and alternatives on coastal flora and fauna, including special-status species. The affected environment and environmental consequences of Project activities that are in the geographic analysis area and extend into state waters (i.e., HDD for cable landfalls and cable laying within 1.0 mile [1.6 kilometers] of cable landfalls) are presented in Section 3.5.2, *Benthic Resources*; Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*; Section 3.5.6, *Marine Mammals*; Section 3.5.7, *Sea Turtles*; and Section 3.4.2, *Water Quality*. Additional information on birds, bats, and wetlands is presented in Section 3.5.3, *Birds*; Section 3.5.1, *Bats*; and Section 3.5.8, *Wetlands*, respectively, and will not be addressed in this section.

3.5.4.1 Description of the Affected Environment

This section describes vegetation communities and associated fauna in the upland portions of the geographic analysis area and includes information on special-status species and habitats in the onshore geographic analysis area. Vegetation communities occurring in wetlands are described in Section 3.5.8, *Wetlands*, while aquatic vegetation and estuarine habitats are described in Section 3.5.2, *Benthic Resources*.

The geographic analysis area encompasses the Falmouth and Brayton Point Onshore Project areas. The Falmouth Onshore Project area falls in the Cape Cod Coastal Lowland and Islands Ecoregion of the Atlantic Coastal Pine Barrens (Griffith et al. 2009). The Brayton Point Onshore Project area is in the Narragansett-Bristol Lowland and Island Ecoregion of the Northeastern Coastal Zone (Griffith et al. 2009; Swain 2020).

[1] As described in Chapter 2, Section 2.1.2, *Alternative B – Proposed Action*, Brayton Point is the preferred ECC for both Project 1 and Project 2, and Falmouth is the variant ECC for Project 2, which would be used if SouthCoast Wind is prevented from using Brayton Point for Project 2.

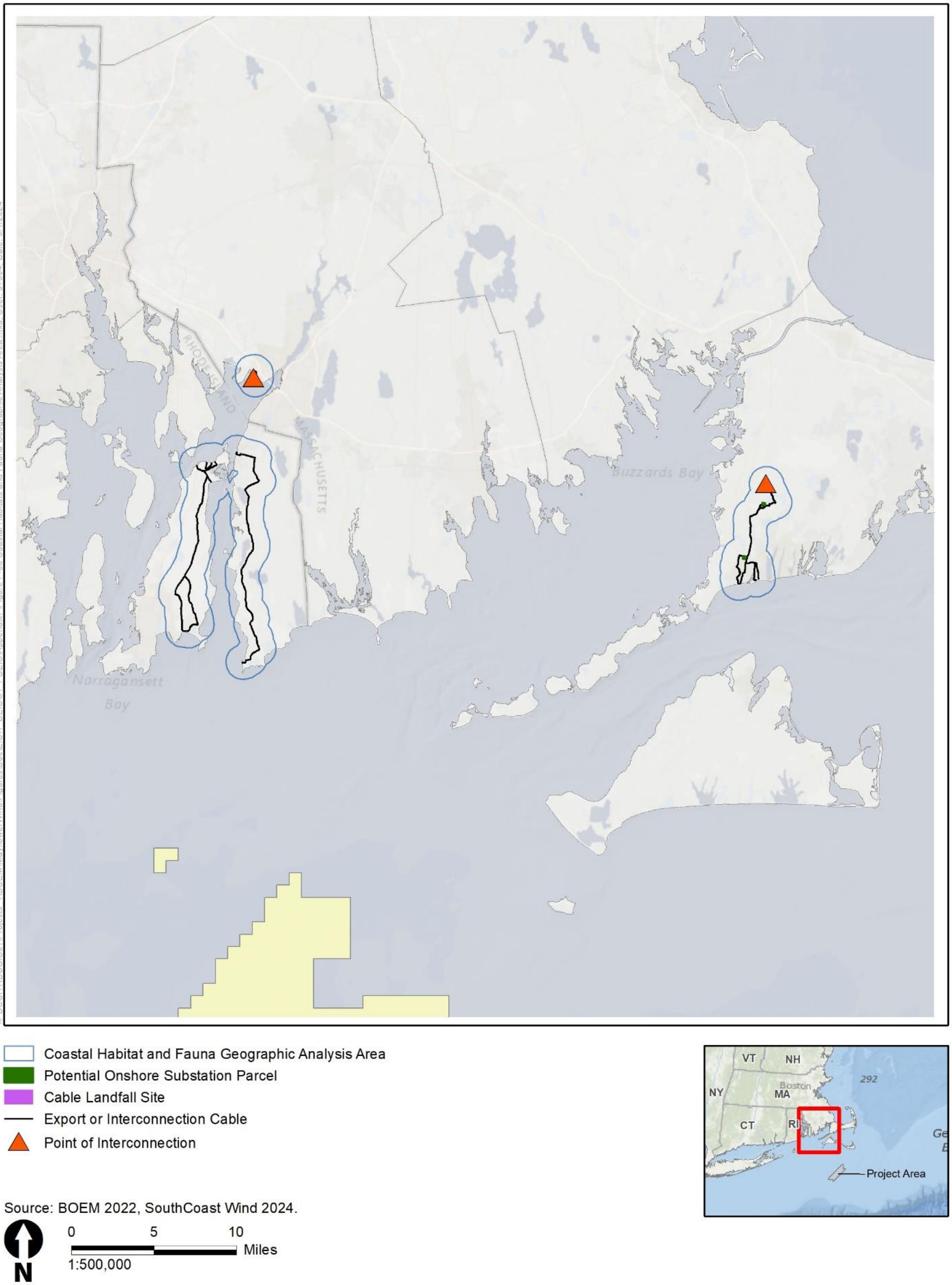


Figure 3.5.4-1. Coastal Habitat and Fauna geographic analysis area

Cape Cod Coastal Lowland and Island Ecoregion (Falmouth Onshore Project Area)

Characteristics of the Cape Cod Coastal Lowland and Island Ecoregion include terminal moraines and outwash plains left by receding glaciers that include habitats such as forests, wetlands, grasslands, scrub-shrub, and fragmented vegetated areas. Most of the land in the Falmouth Onshore Project area is disturbed or developed, with portions of relatively undisturbed land. Desktop studies, wetland delineations, and windshield surveys are summarized in COP Appendix J (SouthCoast Wind 2024). The most likely species to occur in the area include 8 mammals, 11 birds, 6 reptiles, 7 amphibians, and 6 fish species (SouthCoast Wind 2024). Forest and open woodlots serve as the primary habitat for many mammal species, such as Virginia opossum (*Didelphis virginiana*), gray squirrel (*Sciurus carolinensis*), eastern coyote (*Canis latrans*), striped skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*), and white-tailed deer (*Odocoileus virginianus*). Meadow vole (*Microtus pennsylvanicus*) and white-footed mouse (*Peromyscus leucopus*) use the grasslands (SouthCoast Wind 2024). Forests are also used by many bird species: dark-eyed junco (*Junco hyemalis*), blue jay (*Cyanocitta cristata*), and black-capped chickadee (*Poecile atricapillus*). Open woodlots are used by the American robin (*Turdus migratorius*), American crow (*Corvus brachyrhynchos*), mourning dove (*Zenaida macroura*), American goldfinch (*Spinus tristis*), and chipping sparrow (*Spizella passerine*). Ponds, lakes, and wetland are where the red-winged blackbird (*Agelaius phoeniceus*) and the swallow (*Tachycineta bicolor*) are found. The European starling (*Sturnus vulgaris*) is found in developed areas and is an invasive species throughout the United States (Homan et al. 2017). Birds are discussed further in Section 3.5.3, *Birds*.

Many species of reptiles, amphibians, and perennial freshwater fish reside in and around ponds and lakes: painted turtle (*Chrysemys picta)*, spotted turtle (*Clemmys guttata*), spring peeper (*Pseudacris crucifer*), American bullfrog (*Lithobates catesbeianus*), yellow perch (*Perca flavescens*), largemouth bass (*Micropterus salmoides*), chain pickerel (*Esox niger*), black crappie (*Pomoxis nigromaculatus*), bluegill (*Lepomis macrochirus*), and pumpkinseed (*Lepomis gibbosus*) (SouthCoast Wind 2024). Wetlands provide habitat for other reptiles, amphibians, and freshwater fish species: grey treefrog (*Hyla versicolor*), green frog (*Rana clamitans*), spotted salamander (*Ambystoma maculatum*), eastern red-backed salamander (*Plethodon cinereus*), eastern ribbon snake (*Thamnophis sauritus*), and Northern water snake (*Nerodia sipedon*). The Northern ring-necked snake (*Diadophis punctatus*), black racer (*Coluber contrictor*), and fowler's toad (*Anaxyrus fowleri*) inhabit open woodlots.

Narragansett-Bristol Lowland and Islands Ecoregion (Brayton Point Onshore Project Area)

The Narragansett-Bristol Lowland and Islands Ecoregion is relatively flat with gently rolling irregular plains. This ecoregion contains many wetlands, low-gradient streams, and oak and oak-pine forests with combinations of central hardwood species (Swain 2020). Similar species to those found in the Falmouth Onshore Project area are expected to occur in the Project area for the Brayton Point landfall site and export cable routes and substation, in Somerset, Massachusetts. Many migratory birds visit Narraganset Bay in the spring and fall. A significant population of waterfowl are found in the Lee and Cole Rivers IBA, directly adjacent to the Brayton Point landfall site. Other avian species expected to be present include those that inhabit coastal terrestrial habitats, like shore birds, wading birds, raptors, gulls, and seaducks (SouthCoast Wind 2024) and are discussed in Section 3.5.3, *Birds*.

The intermediate landfall site on Aquidneck Island is highly urbanized and, therefore, the species inhabiting that environment have likely adapted to living in urban environments.

The onshore cable routes under Alternative C-1, which traverses Aquidneck Island for approximately 12 miles (19 kilometers), and Alternative C-2, which extends for nearly 16 miles (26 kilometers) through Little Compton and Tiverton, also occur in the Narragansett-Bristol Lowland and Islands Ecoregion. Species inhabiting these areas would be similar to those described for the other Brayton Point Onshore Project facilities.

Coastal Flora Special-Status Species and Habitats

Protected terrestrial species identified by the United States Fish and Wildlife Service (USFWS), Natural Heritage & Endangered Species Program (NHESP), and RIDEM as potentially occurring in the vicinity of the Project area are provided in this section. The MESA also offers further protection for the state-listed species. The USFWS IPaC tool (USFWS 2022) and MassWildlife (NHESP data) (MassWildlife 2022) were used to determine the potential presence of special-status floral species in the geographic analysis area. Personal communications with NHESP were used to confirm the online data include the most recent list of state-protected species (Maier 2022). Additionally, personal communications with RIDEM were used to provide information on protected species in Rhode Island (Jordan 2022). Table 3.5.4-1 provides all threatened or endangered species, besides birds and bats, that may potentially occur in the geographic analysis area.

Table 3.5.4-1. Federally and state-listed endangered and threatened species that may potentially occur in the geographic analysis area

Common Name	Scientific Name	Federal Status [a]	MESA Status [b]	RIDEM Status [c]
Amphibians				
Eastern spadefoot	*Scaphiopus holbrookii*	--	T	--
Fish				
Shortnose sturgeon	*Acipenser brevirostrum*	E	E	--
Invertebrates				
Melsheimer's sack bearer	*Cicinnus melsheimeri*	--	T	--
Collared cycnia	*Cycnia collaris*	--	T	--
The pink streak	*Dargida rubripennis*	--	T	--
Imperial moth	*Eacles imperialis*	--	T	--
Scarlet bluet	*Enallagma pictum*	--	T	--
Pine barrens bluet	*Enallagma recurvatum*	--	T	--
Agassiz's clam shrimp	*Eulimnadia agassizii*	--	E	--
Water-willow borer Moth	*Papaipema sulphurata*	--	T	--
Salt marsh tiger beetle	*Ellipsoptera marginata*	--	--	T

Common Name	Scientific Name	Federal Status [a]	MESA Status [b]	RIDEM Status [c]
Plants				
American chaffseed	*Schwalbea american*	E	--	--
Sandplain gerardia	*Agalinis acuta*	E	E	--
Purple needlegrass	*Aristida purpurascens*	--	T	--
Purple milkweed	*Asclepias purpurascens*	--	E	--
Whorled milkweed	*Asclepias verticillata*	--	T	--
Mattamuskeet rosette-grass	*Dichanthelium mattamuskeetense*	--	E	--
Purple cudweed	*Gamochaeta purpurea*	--	E	--
Saltpond pennywort	*Hydrocotyle verticillata*	--	T	--
Saltpond grass	*Leptochloa fusca* ssp. *fascicularis*	--	T	--
Stiff yellow flax	*Linum medium* var. *texanum*	--	T	--
Dwarf bulrush	*Lipocarpha micrantha*	--	T	--
Adder's tongue fern	*Ophioglossum pusillum*	--	T	--
Eastern prickly pear	*Opuntia humifusa*	--	E	--
Short-beaked beaksedge	*Rhynchospora nitens*	--	T	--
Papillose nut sedge	*Scleria pauciflora*	--	E	--
Grass-leaved ladies'-tresses	*Spiranthes vernalis*	--	T	--
Resupinate bladderwort	*Utricularia resupinata*	--	T	--

[a] USFWS 2022.
[b] MassWildlife 2022.
[c] Jordan 2022.
E= Endangered, T= Threatened

There are two federally listed plant species that may occur in the geographic analysis area: American chaffseed (*Schwalbea american*) and sandplain gerardia (*Agalinis acuta*). American chaffseed is an herbaceous perennial found on the sandy glacial outwash plains in nutrient-poor coils and are often observed with the sandplain gerardia. It is a fire-dependent species and requires open habitats often shaded out by rapidly growing pitch pines and invasives (MassWildlife 2020a). It reaches heights of 12–18 inches (30.5–46 centimeters) and blooms in early July. Though it was last observed on Cape Cod in 1965, a population was found in Barnstable County in 2018 (MassWildlife 2020a). Sandplain gerardia is an annual species that averages 4–8 inches (10–20 centimeters) but can reach heights up to 16 inches (41 centimeters) (MassWildlife 2020b). It grows in dry, sandy soils along roadsides and grasslands and pine-oak forests often where lichens are present Flowering occurs from late August through later September, and the blooms only last a single day (MassWildlife 2020b). The shortnose sturgeon (*Acipenser brevirostrum*) is also listed as federally endangered and may occur in the Onshore Project area. Shortnose sturgeon is an anadromous fish that mainly lives in large freshwater rivers and coastal estuaries. Impacts on shortnose sturgeon are addressed in Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*.

Falmouth Onshore Project Area

Six state-listed endangered plant species may occur in the Falmouth Onshore Project area (Table 3.5.4-1). Examples include the purple milkweed (*Asclepias purpurascens*), papillose nutsedge (*Scleria pauciflora*), and prickly pear (*Opuntia humifusa*). Purple milkweed is found in shrub thickets, open woodlands, pine oak forests, roadsides, and dry fields. They can also be found occasionally in wetlands (Native Plant Trust 2022a). Papillose nutsedge can be found in wetland and non-wetland environments. Prickly pear is the only native cactus in New England and is found on sandy coastal beaches, dunes, grasslands, meadows, and ridges (Native Plant Trust 2022c).

Ten plant species are state listed as threatened and may occur in the Falmouth Onshore Project area (Table 3.5.4-1). Examples include the saltpond pennywort (*Hydrocotyle verticillata*) found along the margins of ponds or in wetland marshes and meadows. The short-beaked bald-sedge (*Rhynchospora nitens*) remains dormant on the banks of sandy or muddy rivers and lakes until water levels are unusually low (Native Plant Trust 2022d), while resupinate bladderwort (*Utricularia resupinate*) is found submerged in shallow water of lakes and ponds (Native Plant Trust 2022e). Adder's tongue fern (*Ophioglossum pusillum*) inhabit marshes and meadows. Saltpond grass (*Leptochloa fusca* ssp. *fascicularis*) does not have a classified wetland status and can inhabit disturbed areas, as well as beaches and marshes (Native Plant Trust 2022b).

Plant species of special concern in the Falmouth Onshore Project area include Wright's rosette-grass (*Dichanthelium wrightianum*), redroot (*Lachnanthes caroliniana*), New England blazing star (*Liatris novae-angliae*), pinnate water-milfoil (*Myriophyllum pinnatum*), pondshore smartweed (*Persicaria puritanorum*), sea-beach knotweed (*Polygonum glaucum*), long-beaked beaksedge (*Rhynchospora scirpoides*), Plymouth gentian (*Sabatia kennedyana*), teretea arrowhead (*Sagittaria teres*), and bristly foxtail (*Setaria parviflora*).

Brayton Point Onshore Project Area

There are no state-listed plant species, or species of special concern that occur in the Brayton Point Onshore Project area, specifically in the area of the intermediate landfall in Aquidneck Island (Jordan 2022).

Coastal Fauna Special-Status Species

Falmouth Onshore Project Area

The USFWS IPaC database did not identify any federally listed threatened or endangered faunal species (non-bird or bat) under the jurisdiction of USFWS in the geographic analysis area; however, the monarch butterfly (*Danaus plexippus*) has a candidate species status (USFWS 2022).

There are no state-listed endangered or threatened reptile species that occur in the Falmouth Onshore Project area (MassWildlife 2022; Maier 2022). Eastern spadefoot (*Scaphiopus holbrookii* – state listed as threatened) is the only listed amphibian potentially occurring in the Falmouth Onshore Project area (Table 3.5.4-1); the species is found burrowing in dry sandy, loamy soils associated with pitch pine barrens, coastal oak woodlands, and sparse shrubs with vernal pools and leaf litter (MassWildlife 2015). Shortnose sturgeon (*Acipenser brevirostrum*) is the only fish species listed as endangered under MESA. Eight state-listed invertebrate species may also potentially occur in the Falmouth Onshore Project area, with Agassiz's clam shrimp (*Eulimnadia agassizii*) being the only state-endangered species listed (Table 3.5.4-1). The other seven invertebrate species—Melsheimer's sack-bearer (*Cicinnus melsheimeri*), collared cycnia (*Cycnia collaris*), pink-streak (*Dargida rubripennis*), imperial moth (*Eacles imperialis*), scarlet bluet (*Enallagma pictum*), pine barrens bluet (*Enallagma recurvatum*), and water-willow stem borer moth (*Papaipema sulphurate*)—are listed as threatened.

Species of special concern in the Falmouth Onshore Project area include eastern box turtle (*Terrapene Carolina*), eastern hog-nosed snake (*Heterodon platirhinos*), bridle shiner (*Notropis bifrenatus*), coastal heathland cutworm (*Abargrotis nefascia*), frosted elfin (*Callophrys irus*), Herodias underwing moth (*Catocala herodias*), purple tiger beetle (*Cicindela purpurea*), chain dot geometer (*Cingilia catenaria*), buck moth (*Hemileuca maia*), tidewater mucket (*Leptodea ochracea*), American clam shrimp (*Limnadia lenticularis*), pink sallow moth (*Psectraglaea carnosa*), pine barrens speranza (*Speranza exonerate*), and pine barrens zale (*Zale lunifera*).

Brayton Point Onshore Project Area

The Brayton Point Onshore Project area includes Aquidneck Island as well as Little Compton, and Tiverton (as part of Alternative C) in Rhode Island and Brayton Point in Massachusetts. The USFWS IPaC database did not identify any federally listed threatened or endangered faunal species (non-bird or bat) under the jurisdiction of USFWS in the Brayton Point Onshore Project area; however, the monarch butterfly (*Danaus plexippus*) has a candidate species status (USFWS 2022).

The only state-listed species that may occur in the Rhode Island section is the salt marsh tiger beetle (*Ellipsoptera marginata*), listed as threatened (Jordan 2022). Adult tiger beetles emerge in the fall to feed until the cold winter months. They burrow underground until the spring when they emerge to feed, mate and lay eggs, burrow underground, and hibernate the winter. Habitat loss, disturbance, sea-level rise, and tidal erosion all pose threats for these beetles (SouthCoast Wind 2024).

Terrestrial Habitats and Wildlife

Falmouth Onshore Project Area

The Falmouth Onshore Project area consists of three landfall sites, onshore export cable routes, and two potential substation sites. Most of the Onshore Project area is highly developed with areas of dense residential, commercial and industrial development, although there are areas of open space and rural residential development that provide higher quality habitat. COP Volume 2, Section 6.3.1.1.2, Figure 6-7 shows the land use in the Falmouth Onshore Project area (SouthCoast Wind 2024). Only species adapted to urban environments are anticipated to be in the Falmouth Onshore Project area.

The three landfall sites considered—Central Park, Shore Street, and Worcester Avenue—consist of coastal beach community habitat adjacent to developed areas. The Worcester Avenue and Central Park landfall locations are of low ecological value, largely consisting of mowed lawns and other areas common to human disturbance and presence. The Shore Road landfall location is largely developed and devoid of natural communities (SouthCoast Wind 2024).

From the coastline, the Falmouth onshore export cable routes would traverse mostly developed areas of Falmouth, Massachusetts. Natural communities present along the Falmouth onshore export cable routes and underground transmission route include bare land, deciduous forest, developed open space, evergreen forest, grassland, impervious, wetlands, scrub/shrub, and unconsolidated shore. Some export cable route segments would traverse natural pockets of undisturbed environments. Species that thrive in edge environments are likely to be found in these areas (COP Appendix J; SouthCoast Wind 2024).

The two sites being considered for the onshore substation, the Lawrence Lynch site and the Cape Cod Aggregates site, primarily consist of disturbed and developed land currently used for sand and gravel mining and processing. At the Lawrence Lynch site, there are several constructed stormwater ponds on the site but these features are not considered a valuable resource for wildlife, fish, or other aquatic life due to their highly altered nature and function as a stormwater management facility (COP Appendix J; SouthCoast Wind 2024).

Brayton Point Onshore Project Area

The Brayton Point Onshore Project area consists of several potential landfall sites, onshore export cable routes, and up to two converter stations. The Brayton Point Onshore Project area is situated in an ecoregion that is relatively flat with most elevations under 200 feet (61 meters) (Griffith et al. 2009). Terrestrial habitats for wildlife in the Onshore Project areas and the immediate vicinity of the proposed Project include forested land, disturbed or developed land, wetland areas, grasslands, scrub-shrub areas, fragmented vegetated habitats, and coastal habitats. These habitats are predominately composed of disturbed or developed lands (SouthCoast Wind 2024).

Intermediate Landfalls and Export Cable Routes

The natural communities at the intermediate landfalls and along the export cable routes on Aquidneck Island include developed land, developed recreation, impervious surfaces, and wetlands (SouthCoast Wind 2024).

The onshore export cable route under Alternative C-1 would make landfall at the southern end of Aquidneck Island and then traverse the island for approximately 12 miles (19 kilometers). Terrestrial habitats along the export cable route are mainly developed or agricultural lands. Other natural communities include deciduous forest, brushland, mixed forest, and wetlands. The onshore export cable route under Alternative C-2 would pass through Little Compton and Tiverton, Rhode Island for approximately 16 miles (26 kilometers). Terrestrial habitats along the route include developed or agricultural lands, with some deciduous forest, brushland, and wetlands.

Brayton Point Landfall, Export Cable Routes, and Converter Stations

Two landfall sites were investigated and are being considered at Brayton Point: western, from the Lee River on the western side of Brayton Point, and eastern from the Taunton River on the eastern side of Brayton Point. Both landfall locations are generally devoid of natural communities as they consist of roads and former industrial facilities (SouthCoast Wind 2024). The proposed onshore export cable route would be installed within and below existing developed land to up to two HVDC converter stations. The converter stations at Brayton Point would be constructed at the former Brayton Point Power Station in Somerset, Massachusetts (SouthCoast Wind 2024). The site is largely developed with limited habitat resources available.

3.5.4.2 Impact Level Definitions for Coastal Habitat and Fauna

Impact level definitions for coastal habitat and fauna are provided in Table 3.5.4-2.

Table 3.5.4-2. Definitions of impact levels for coastal habitat and fauna

Impact Level	Type of Impact	Definition
Negligible	Adverse	No effect or no measurable impact on coastal habitats or fauna.
Minor	Adverse	Impacts from which coastal habitats or fauna would recover completely without mitigating action.
Moderate	Adverse	Notable and measurable impacts from which coastal habitats or fauna would recover completely with mitigating action.
Major	Adverse	Regional or population-level impacts from which coastal habitats or fauna would not recover.

3.5.4.3 Impacts of Alternative A – No Action on Coastal Habitat and Fauna

When analyzing the impacts of the No Action Alternative on coastal habitat and fauna, BOEM considered the impacts of ongoing activities, including ongoing non-offshore wind and ongoing offshore wind activities on the baseline conditions for coastal habitat and fauna. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities, as described in Appendix D*, Planned Activities Scenario*.

Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for coastal habitat and fauna Section 3.5.4.1, *Description of the Affected Environment and Future Baseline Conditions* would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities. Ongoing non-offshore wind activities in the geographic analysis area that contribute to impacts on coastal habitat and fauna are generally associated with onshore impacts, including onshore coastal development (e.g., residential, commercial, industrial) and climate change. Onshore construction activities and associated impacts are expected to continue at current trends and have the potential to affect coastal flora and fauna through temporary and permanent habitat removal or conversion, temporary noise impacts during construction, and lighting, which could cause avoidance behavior and displacement of animals, as well as injury or mortality to individual animals or loss and alteration of vegetation and individual plants. However, population-level effects would not be anticipated. Ongoing climate change can increase storm frequency and severity, disturbing the established coastal community. Sea-level rise has also resulted in habitat loss due to coastal flooding and rising water tables (Sacatelli et al. 2020). The wetlands, dunes, and beaches are inherently vulnerable and erode in the storms, creating moving shorelines that fluctuate seasonally (USEPA 2016). Climate change may also affect coastal habitats through the earlier arrival of spring bringing more precipitation, heavier rainstorms, and summer temperatures that are hotter and drier (USEPA 2016). These shifting rainfall patterns increase the intensity of both floods and droughts, which may affect populations of terrestrial and coastal plants and animals. For instance, vernal pools, such as those found in the Falmouth Onshore Project area, are typically filled with water in the fall or winter due to rainfall and seasonal high groundwater levels and remain ponded through the spring and into summer. However, often vernal pools dry up completely by the middle or end of the summer, or at least every few years, preventing fish populations from becoming established in the pool. Invasive species emerge earlier in the year, expand their range into new ecosystems, become more competitive, and can take advantage of the already stressed species more effectively as a result of higher concentrations of carbon dioxide from warming temperatures (Beaury et al. 2020). The increase of deer populations from these warmer temperatures earlier in the year leads to the loss of forest underbrush, leaving other species more vulnerable (USEPA 2016). The effects of climate change on other animals will likely include loss of habitat (Sacatelli et al. 2020), population declines, increased risk of extinction, decreased reproductive productivity, and changes in species distribution.

There are no ongoing offshore wind activities in the geographic analysis area for coastal habitat and fauna.

Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative in combination with the other planned non-offshore wind activities and planned offshore wind activities (without the Proposed Action).

Other planned non-offshore wind activities that may affect coastal habitat and fauna primarily include increasing onshore development activities (see Appendix D, Section D.2, for a description of planned activities). Similar to ongoing activities, other planned non-offshore wind activities may result in temporary and permanent impacts on animals and vegetation, including disturbance, displacement, injury, mortality, habitat and plant degradation and loss, and habitat conversion.

Within the Massachusetts and Rhode Island lease areas, there are several approved and proposed offshore wind projects adjacent to the SouthCoast Wind Lease Area. However, at this time BOEM is not aware of any onshore components of other offshore wind projects that would co-occur or overlap with the geographic analysis area for coastal habitat and fauna for the Proposed Action. If any offshore wind activities are identified that would occur in the geographic analysis area, impacts would be similar to those under the Proposed Action, and any adverse impacts on coastal habitats and fauna would be minimal.

BOEM expects other offshore wind activities (without the Proposed Action) to affect coastal habitat and fauna through the following primary IPFs.

Noise: Onshore noise associated with intermittent construction of required offshore wind development infrastructure may result in localized and temporary impacts on coastal fauna, including avoidance and displacement, although no individual fitness or population-level effects would be expected to occur. Displaced wildlife could use adjacent habitats and would repopulate these areas once construction ceases. Onshore construction noise associated with other offshore wind activities (without the Proposed Action) is expected to result in temporary, localized, and negligible impacts.

Land disturbance: Onshore construction of offshore wind development infrastructure has the potential to result in some impacts due to habitat loss or fragmentation. However, onshore construction would be expected to account for only a very small increase in development relative to other ongoing development activities. Furthermore, construction would be expected to generally occur in previously disturbed habitats, and no individual fitness- or population-level impacts on coastal habitat and fauna would be expected to occur. As such, onshore construction impacts associated with offshore wind development (without the Proposed Action) would be minor, short-term, and would not be expected to appreciably contribute to overall impacts on coastal habitat and fauna.

Presence of structures: Additional structures and cables that are anticipated to be constructed in association with future offshore wind activities would not be expected to affect coastal fauna at the individual or population level considering the anticipated placement of most onshore wind components in developed areas. Impacts would be long-term but negligible.

Traffic: If the use of construction equipment or vehicles from other offshore wind developments overlapped the geographic analysis area, collisions with coastal wildlife could occur. However, those collisions are expected to be rare because most of the wildlife are expected to avoid construction areas or have the mobility to avoid construction equipment. Therefore, impacts on coastal fauna from traffic resulting from other offshore wind developments (without the Proposed Action) would be expected to be short-term, temporary during the construction period, and negligible.

Impacts of Alternative A on ESA-Listed Species

Two ESA-listed plant species occur or potentially occur in the geographic analysis area. Any future federal or private activities that could affect federally listed species in the geographic analysis area would need to comply with ESA Section 7 or Section 10, respectively, to ensure that the proposed activities would not jeopardize the continued existence of the species.

Conclusions

Impacts of the No Action Alternative: Under the No Action Alternative, coastal habitats and fauna would continue to be affected by existing environmental trends and ongoing activities. BOEM expects ongoing activities to have continuing temporary and permanent impacts (disturbance, habitat loss, displacement, injury, and mortality) on coastal habitat and fauna, primarily through onshore coastal construction and climate change. BOEM anticipates that the potential impacts of ongoing construction activities on coastal habitat and fauna would be minor but impacts from climate change could be moderate. Therefore, the No Action Alternative would result in **moderate adverse** impacts on coastal habitats, primarily driven by climate change.

Cumulative Impacts of the No Action Alternative: Under the No Action Alternative, existing environmental trends and ongoing activities would continue, and coastal habitat and fauna would continue to be affected by natural and human-caused IPFs. Planned activities would contribute to the impacts on coastal habitat and fauna through construction-related activities that affect habitat, vegetation, and wildlife. Currently, there are no future offshore wind activities proposed in the geographic analysis area. If any were to occur, they would have some potential to result in temporary disturbance and permanent loss of onshore habitat. However, habitat removal is anticipated to be minimal due to the developed and urbanized landscape of the geographic analysis area. Any impacts resulting from habitat loss or disturbance would not be expected to result in population-level effects on species in the geographic analysis area. BOEM anticipates the cumulative impacts of the No Action Alternative would be **moderate adverse**, primarily driven by ongoing construction activities and climate change.

3.5.4.4 Relevant Design Parameters and Potential Variances in Impacts

This EIS analyzes the maximum-case scenario; any potential variances in the proposed Project build-out as defined in the PDE would result in impacts similar to or less than those described in the sections below. The following proposed PDE parameters (Appendix C, *Project Design Envelope and Maximum-Case Scenario*) would influence the magnitude of the impacts on coastal habitat and fauna.

- The onshore export cable routes, including routing variants, and extent of land disturbance for new onshore substations, which could require the removal of vegetation.

Variability of the proposed Project design exists as outlined in Appendix C. The following summarizes potential variances in impacts.

- Onshore export cable routes and substation footprints: The route chosen (including variations of the general route) and substation footprints would determine the amount of habitat affected.

SouthCoast Wind has committed to measures to minimize impacts on coastal habitat and fauna, including avoiding areas of unique or protected habitat or known habitat for threatened or endangered and candidate species to the extent practicable and conducting maintenance and repair activities in a manner to avoid or minimize impacts on sensitive species and habitat. Onshore export cables would be buried beneath existing roadways and SouthCoast Wind would implement construction best management practices such as erosion and sediment control measures where needed. SouthCoast Wind would train construction staff on biodiversity management and environmental compliance requirements and implement a Vegetation Management Plan (Appendix G, Table G-1; COP Volume 2, Section 16, Table 16-1; SouthCoast Wind 2024).

3.5.4.5 Impacts of Alternative B – Proposed Action on Coastal Habitat and Fauna

The following summarizes the potential impacts of the Proposed Action on coastal habitat and fauna and special-status species during the various phases of the Project. Routine activities would include construction, O&M, and decommissioning of the Project, as described in Chapter 2, *Alternatives*.

Noise: Construction noise is anticipated at the landfall sites (primarily associated with HDD activities), along the onshore export cable routes, and at substation and converter station locations. Impacts, if any, are expected to be limited to behavioral avoidance of construction activity and noise. Construction would predominantly occur in already developed areas where wildlife is habituated to human activity and noise. Displaced individuals would likely return to the affected areas once the noise has ended, and BOEM anticipates temporary and negligible impacts from construction noise. Normal operation of the substation and converter stations would generate continuous noise. Terrestrial fauna may habituate to noise so that it has little to no effect on their behavior or biology (Kight and Swaddle 2011). For this reason, BOEM expects minimal impacts on coastal fauna from onshore O&M, especially given that terrestrial fauna in this area is likely to be already subject and habituated to anthropogenic noise from other nearby sources in the developed landscape surrounding the substation and converter station locations. Onshore O&M noise is expected to result in long-term, localized, and minor impacts.

Land disturbance: Construction of the onshore export cables, substation, and converter stations at Falmouth and Brayton Point would result in land disturbance of various coastal vegetation communities, which are quantified in COP Appendix J, Table 4-1 and Table 4-2 (SouthCoast Wind 2024). Impacts on habitat from onshore construction activities would be limited because facilities would be located mostly in existing developed areas. The onshore Project components are sited in existing paved areas, public road ROW, and developed industrial areas to the maximum extent practicable.

In the Falmouth Onshore Project area, offshore export cables would make landfall in Falmouth and connect to one of two substation sites. None of the onshore export cable routes would affect substantial areas of natural habitat or vegetation communities. The onshore cable routes would be installed to the greatest extent feasible in the disturbed road ROW, with the result that most impacts on natural communities would be avoided. Tree and vegetation clearing would be less than 0.5 acre (0.2 hectare) for each of the onshore export cables route options (COP Volume 2, Section 6.3.1.1.2; SouthCoast Wind 2024). The maximum footprint of the substation would be up to 26 acres (10.5 hectares), mostly comprised of disturbed land that provides minimal habitat value.

Depending on the specific landfalls, cable routes, and substation sites selected, there would be between 43 and 151 acres (17 and 61 hectares) of natural communities in the Falmouth Onshore Project area with the potential to be affected by construction, operation, and decommissioning activities of the Proposed Action (COP Appendix J, Table 4-1; SouthCoast Wind 2024). Of these affected areas, 76 percent and 52 percent, respectively, consist of impervious surface, bare land, and developed open space, where there would be no to minimal vegetation affected. The remaining 10–72 acres (4–29 hectares) of affected vegetation communities include coastal beach, unconsolidated shore, deciduous forest, wetlands, scrub, evergreen forest, grasslands, water, and wetlands, depending on the specific Project component. It is anticipated that direct effects on sensitive environmental resources, such as wetlands, would be avoided to the maximum extent practicable during the detailed design and construction of the Project. As such, the area of natural community types ultimately altered by the route is anticipated to be less than the acreages identified above (COP Appendix J; SouthCoast Wind 2024).

Within the Brayton Point export cable corridor, export cables would come ashore for the intermediate landfall on Aquidneck Island. HDD would be used to enter and exit Aquidneck Island to avoid potential impacts on nearby tidal zones, eelgrass zones, coastal dunes, and public beaches. A 3-mile (4.8-kilometer) underground onshore export cable, using one of three potential routes, would cross the island using existing roadways where feasible, which would minimize the potential impacts on vegetation communities. At Brayton Point, the export cables would connect to the site of the HVDC converter stations, which is mostly comprised of developed and disturbed land with minimal habitat value.

Depending on the routes selected, there would be between 62 and 69 acres (25 and 28 hectares) of natural communities within the Brayton Point Onshore Project area with the potential to be affected by construction, O&M, and decommissioning activities of the Proposed Action (COP Appendix J, Table 4-2; SouthCoast Wind 2024). Of the total 69 acres, approximately 84 percent consists of impervious surface, bare/vacant land, and developed open space, where there would be no to minimal vegetation affected. The remaining 11 acres (4 hectares) of affected vegetation communities include beaches, deciduous forest, scrub/shrub, and grassland, depending on the specific Project component.

To limit land disturbance whenever possible, SouthCoast Wind would co-locate facilities and onshore export cables with existing developed areas (i.e., roads and existing transmission ROWs). By using the HDD to transition onshore, the impacts on beaches and nearshore vegetated natural habitats would be avoided for all options. Due to the very small area needed for HDD operations, compared to the amount of suitable habitat available in Falmouth and in the vicinity of Brayton Point, species in the area are not expected to be meaningfully affected by the short-term and temporary construction activity. Some previously disturbed areas of maintained roadside vegetation may be affected during construction, dependent upon workspace requirements for equipment. Additional ground disturbance and the introduction of new impervious surface would be required at the onshore substation and converter station sites.

SouthCoast Wind has committed to implementing various measures to avoid and minimize impacts on coastal habitat and fauna. These including contacting appropriate federal or state agencies should tree clearing be required, implementing a Vegetation Management Plan and installing sediment erosion controls near waterbodies to minimize impacts on these resources, and training construction staff on biodiversity management and environmental compliance requirements. To the greatest extent practicable, construction would take place away from significant fish and wildlife habitats and during times when highly sensitive species are not likely to be present. Overall, land disturbance under the Proposed Action is anticipated to have short-term and long-term minor impacts on coastal flora and fauna habitats.

Presence of structures: Because most of the area where onshore Project components would be constructed and operated is developed and urbanized, the wildlife communities are composed of disturbance-tolerant species inhabiting an area with existing structures, cables, and other infrastructure. Export cables would be buried and therefore, following construction and reclamation, would not contribute to impacts on coastal habitat and fauna. Additional structures and cables from the onshore Project components would not alter the characteristics of the existing environment to an extent that would alter wildlife species composition, population sizes, or individual fitness, leading to long-term, negligible impacts.

Traffic: Collisions between wildlife and vehicles or construction equipment would be rare because most wildlife are expected to avoid construction areas or have the mobility to avoid construction equipment. The species likely to be present in the Project area are also acclimated to urban environments and are less vulnerable to development and traffic. However, individuals that are not able to move away from disturbed areas (e.g., juveniles in nests) or those that occupy a single tree being removed (e.g., invertebrates) could be more vulnerable to this impact, particularly during land clearing and ground excavation. To the extent practicable, construction activities would take place outside of periods when highly sensitive species are likely to be present. SouthCoast Wind has identified a preliminary list of timing restrictions it would adhere to, including illuminating equipment at night, clearing trees in colder months, and avoiding known raptor nests during nesting periods (COP Appendix J, Section 5.4.2.4; SouthCoast Wind 2024). While these restrictions are intended to minimize impacts on birds and bats, they may also benefit other species. Routine O&M activities are likely to have less potential for direct injury or fatality for wildlife than the construction phase. SouthCoast Wind would develop a Vegetation Management Plan and implement best management practices to minimize potential impacts on vegetation communities during construction. In addition, vehicle speed limits would be enforced at all Project sites. Population-level effects are not expected to occur. Impacts would be short term, temporary during the construction period, and negligible.

Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned non-offshore wind and offshore wind activities. Ongoing and planned non-offshore wind activities related to onshore development activities would contribute to impacts on coastal habitat and fauna through the primary IPFs of noise, presence of structures, land disturbance, and traffic. The construction, O&M, and decommissioning of onshore infrastructure for the Proposed Action would contribute to impacts primarily associated with temporary disturbance and permanent loss of habitat onshore. BOEM is not aware of any offshore wind activities other than the Proposed Action that would overlap the geographic analysis area for coastal habitat and fauna. But if habitat removal is anticipated, it would be minimal and any related impacts would not be expected to result in individual fitness or population-level effects in the geographic analysis area.

The cumulative impact on coastal habitat and fauna would likely be moderate, mostly driven by climate change. The Proposed Action onshore cable routes and substation/converter stations sites are located in developed areas where there is limited natural habitat and wildlife is habituated to human activity and noise. In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the cumulative impacts on coastal habitat and fauna.

Impacts of Alternative B on ESA-Listed Species

Impacts of the Proposed Action on ESA-listed birds, bats, and fish are represented in the IPF text in Section 3.5.3, *Birds*, Section 3.5.1, *Bats*, and Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*. One ESA-listed plant species occurs or potentially occurs in the geographic analysis area.

BOEM prepared a BA assessing the potential effects on federally listed species (BOEM 2023). Consultation with USFWS pursuant to Section 7 of the ESA was concluded on September 1, 2023. In USFWS's transmittal letter for the Biological Opinion, USFWS concurred with BOEM's determination of may affect, but is not likely to adversely affect, for the northern long-eared bat (*Myotis septentrionalis*; endangered), tri-colored bat (*Perimyotis subflavus*; proposed endangered), roseate tern (*Sterna dougallii dougallii*; endangered), monarch butterfly (*Danaus plexippus*; proposed), and sandplain gerardia (*Agalinis acuta*; endangered) (USFWS 2023).

Conclusions

Impacts of the Proposed Action: Construction and installation, O&M, and conceptual decommissioning of the Proposed Action would have **moderate adverse** impacts on coastal habitat and fauna because most potential effects would be localized and short-term and could be minimized with mitigation measures and other best management practices.

Cumulative Impacts of the Proposed Action: BOEM anticipates that the cumulative impacts on coastal habitat and fauna in the geographic analysis area would be **moderate adverse**, mostly driven by climate change. In context of reasonably foreseeable environmental trends, the incremental impacts contributed by the Proposed Action to the cumulative impacts on coastal habitat and fauna would be undetectable. The Proposed Action would contribute to the cumulative impacts primarily through the permanent impacts from habitat loss from onshore construction.

3.5.4.6 Impacts of Alternative C on Coastal Habitat and Fauna

Impacts of Alternative C: The export cable route to Brayton Point under Alternative C-1 and Alternative C-2 would be rerouted onshore to avoid sensitive fish habitat in the Sakonnet River, which would increase impacts on coastal habitat and fauna compared to the Proposed Action. The Alternative C-1 onshore export cable route would be installed largely within existing road ROWs on Aquidneck Island, increasing the total length of the onshore cable route by approximately 9 miles (14 kilometers). The Alternative C-2 onshore export cable route would be installed largely within existing road ROWs in Little Compton and Tiverton, increasing the total length of the onshore cable route by approximately 13 miles (21 kilometers). The increase of land disturbance and the routes' passage through towns and tourist destinations under both alternatives would require a longer construction schedule than the Proposed Action due to the complexity of working in developed areas with multiple property owners and confined spaces for cable installation, affecting coastal habitat and fauna for a longer period of time than the Proposed Action.

The types of impacts under Alternative C-1 and Alternative C-2 would be similar to those described for the Proposed Action, but slightly greater due to the larger area of land disturbance in coastal habitats. Approximately 68 percent and 56 percent of Alternative C-1 and Alternative C-2, respectively, consist of developed land cover types, with the remaining area consisting of natural vegetation land cover. Table 3.5.4-3 summarizes the vegetation communities within the Alternative C-1 and C-2 onshore export cable routes that could be directly affected by installation of the cables. Alternative C-2 would result in the greatest impact on coastal habitat and fauna because more acres of natural vegetation would be affected than under Alternative C-1. The vegetated areas presented in Table 3.5.4-3 are in addition to the areas affected by the Proposed Action because the export cable routes under this alternative would effectively replace an offshore segment of the Proposed Action's overall export cable route. Alternative C-1 crosses near the Sachuest Point National Wildlife Refuge and may result in temporary impacts on wildlife in the refuge during construction activity. The onshore cable routes under both Alternative C-1 and Alternative C-2 would be installed within existing road ROWs to the extent feasible; however, the alternate routes may require pathways in road shoulder, median, and off-road, including private property, transmission ROWs, stream/wetland crossings, and railroad ROWs due to the narrower roads lined with historic stonewalls and structures in the southern portions of the alternate routes. Despite this, impacts on coastal habitat and fauna under either alternative would be limited to the immediate vicinity of the roadway where there is already limited habitat.

Table 3.5.4-3. Vegetation potentially affected by Alternatives C-1 and C-2 onshore export cables (acres)

Vegetation Community	Alternative C-1 East	Alternative C-1 West	Alternative C-2
Brushland	1.51	1.07	1.31
Agriculture [a]	8.99	8.84	15.08
Mixed Forest	1.34	0.80	0.31
Softwood Forest	0	0	0.09
Deciduous Forest	3.61	1.79	15.06
Sandy Areas [b]	0.20	0.20	0.51
Wetlands [c]	0.92	3.31	1.27
Total	**16.57**	**16.01**	**33.63**

Source: RIGIS 2011.
[a] Agriculture includes cropland (tillable), abandoned fields/orchards, pastures, orchards, groves, and nurseries.
[b] Sandy Areas include beach and non-beach sandy areas. Note, Alternative C-2 does not have any beach sandy areas, and each sandy area for Alternative C-1 would be avoided with HDD.
[c] The wetland areas presented in this table are based on a broad land cover GIS dataset and do not substitute for the more accurate wetlands GIS data used to generate wetland impacts in Section 3.5.8, *Wetlands*.

Cumulative Impacts of Alternative C: The cumulative impacts on coastal habitat and fauna would be moderate for the same reasons described for the Proposed Action. In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative C to the cumulative impacts on coastal habitat and fauna would be slightly greater than the Proposed Action but would still represent an undetectable increment.

Impacts of Alternative C on ESA-Listed Species

Impacts on ESA-listed species would be similar to the Proposed Action, with proportionally more land disturbance due to the longer onshore cable component of Alternative C-1 and Alternative C-2 compared to the Proposed Action.

Conclusions

Impacts of Alternative C: Activities associated with the construction, installation, O&M, and eventual decommissioning of Alternative C would have **minor** short-term impacts on coastal habitat and fauna, depending on the location, timing, and species affected by an activity. The primary impacts of Alternative C affecting coastal habitat and fauna would be habitat loss.

Cumulative Impacts of Alternative C: In context of other reasonably foreseeable environmental trends, the cumulative impacts of Alternative C on coastal habitat and fauna would be similar to the Proposed Action and result in a **moderate** impact.

3.5.4.7 Impacts of Alternatives D (Preferred Alternative), E, and F on Coastal Habitat and Fauna

Impacts of Alternatives D, E, and F: Because Alternatives D, E, and F would involve modifications only to offshore components, impacts on coastal habitat and fauna from Alternatives D, E, and F would be the same as those under the Proposed Action.

Cumulative Impacts of Alternatives D, E, and F: In context of reasonably foreseeable environmental trends, the cumulative impacts of Alternatives D, E, and F would be the same as those described for the Proposed Action.

Impacts of Alternatives D, E, and F on ESA-Listed Species

Impacts on ESA-listed species would be the same as the Proposed Action.

Conclusions

Impacts of Alternatives D, E, and F: As discussed above, the anticipated **moderate adverse** impacts under the Proposed Action would not change under Alternatives D, E, and F.

Cumulative Impacts of Alternatives D, E, and F: In context of reasonably foreseeable environmental trends, the cumulative impacts of Alternatives D, E, and F would be the same as those described for the Proposed Action and result in **moderate adverse** impacts.

3.5.4.8 Comparison of Alternatives

Under Alternative C, the export cable route to Brayton Point would be rerouted onshore resulting in increased impacts on coastal habitat and fauna compared to the Proposed Action. The overall affected area would be small, and the anticipated minor impacts associated with the Project would not change substantially under Alternative C. Therefore, the overall impact level on coastal habitat and fauna would not change—moderate adverse.

Because Alternatives D, E, and F involve modifications only to offshore components, impacts on coastal habitat and fauna from those alternatives would be the same as those under the Proposed Action—moderate adverse.

In the context of reasonably foreseeable environmental trends, the cumulative impacts associated with Alternatives C, D, E, and F when each is combined with the impacts from ongoing and planned activities would be the same as for the Proposed Action—moderate adverse.

3.5.4.9 Proposed Mitigation Measures

No measures to mitigate impacts on coastal habitat and fauna have been proposed for analysis.

3.5 Biological Resources

3.5.5 Finfish, Invertebrates, and Essential Fish Habitat

This section discusses potential impacts on finfish, invertebrates, and EFH from the proposed Project, alternatives, and ongoing and planned activities in the finfish, invertebrates, and EFH geographic analysis area. The geographic analysis area, as shown on Figure 3.5.5-1., includes the Northeast Continental Shelf Large Marine Ecosystem (LME),[1] which extends from the southern edge of the Scotian Shelf (in the Gulf of Maine) to Cape Hatteras, North Carolina, likely encompassing the majority of movement ranges for most invertebrates and finfish species. The entirety of the geographic analysis area includes only U.S. waters. Due to the size of the geographic analysis area, the analysis in this EIS focuses on finfish and invertebrates that would be likely to occur in the Project area and be affected by Project activities.

Some Project vessels are expected to transit through the Gulf of Mexico to and from the Port of Corpus Christi and Port of Altamira, Mexico (Section 3.6.6, *Navigation and Vessel Traffic*). However, approximately 71 vessel trips during construction and 9 vessel trips during decommissioning anticipated to these ports is a relatively small amount, and no trips would occur during O&M. Typical vessel routes through the Gulf of Mexico from the Port of Corpus Christi and Port of Altamira, Mexico, have limited steam time within waters where five ESA-listed fish species may occur, including gulf sturgeon (Ross et al. 2009), Nassau grouper (NMFS 2023), smalltooth sawfish (NMFS 2018), scalloped hammerhead shark (NMFS 2020b), and giant manta ray (Farmer et al. 2022). Vessels transiting to and from Corpus Christi, Texas, and the Port of Altamira, Mexico, are expected to follow general traffic patterns through the Straits of Florida and across the Gulf of Mexico, far offshore of the shallow nearshore waters occupied by gulf sturgeon, Nassau groupers, and smalltooth sawfish. The dispersed distribution of giant manta rays in the open ocean habitat where Project vessels would transit and the low number of reported vessel strikes for scalloped hammerhead sharks indicate that vessel interactions with these species are less likely to occur. Given known habitat preferences and species distributions, and the slow speeds at which vessels would be traveling through the Gulf of Mexico, Project vessels are not expected to encounter or cause impacts on any of these ESA-listed species. Other vessel-related impacts that may occur in the Gulf of Mexico are expected to be negligible (e.g., accidental releases) (Section 3.5.5.5, *Impacts of Alternative B – Proposed Action on Finfish, Invertebrates, and Essential Fish Habitat*). For these reasons, impacts in the Gulf of Mexico are not considered further.

[1] LMEs are delineated based on ecological criteria, including bathymetry, hydrography, productivity, and trophic relationships among populations of marine species, and the National Oceanic and Atmospheric Administration (NOAA) uses them as the basis for ecosystem-based management.

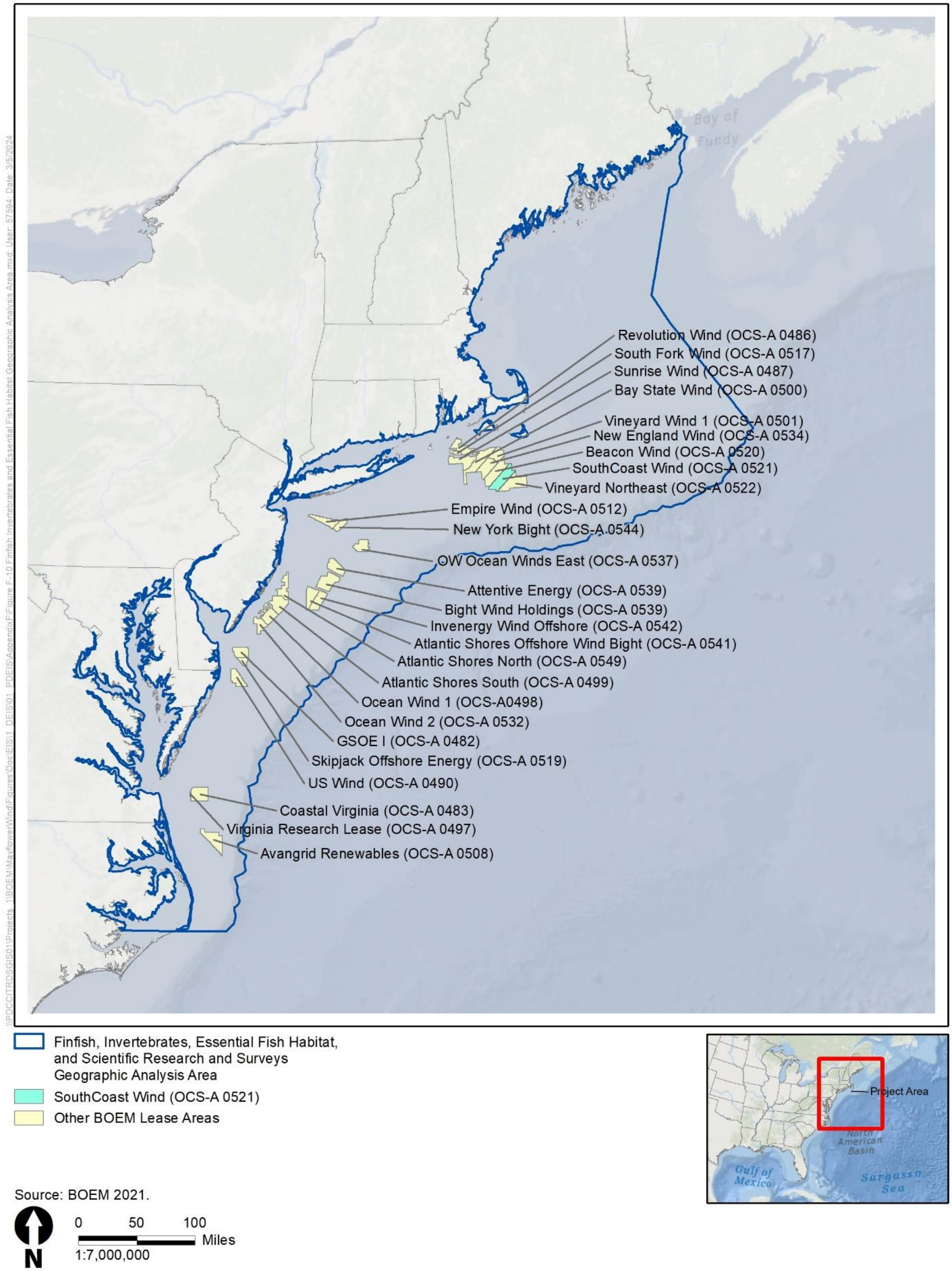


Figure 3.5.5-1. Finfish, invertebrates, and essential fish habitat geographic analysis area

This section provides a qualitative assessment of the impacts of each alternative on finfish, invertebrates, and EFH, which has been designated under the Magnuson-Stevens Fishery Conservation and Management Act as “essential” for the conservation and promotion of specific fish and invertebrate species. A discussion of benthic species is provided in Section 3.5.2, *Benthic Resources*, and a discussion of commercial fisheries and for-hire recreational fishing is provided in Section 3.6.1, *Commercial Fisheries and For-Hire Recreational Fishing*.

3.5.5.1 Description of the Affected Environment

Finfish

The geographic analysis area is the LME, which was selected based on the likelihood of capturing the majority of movement range for most finfish species that would be expected to pass through the Project area. This area is large and has very diverse and abundant fish assemblages that can be generally categorized based on life history and preferred habitat associations (e.g., pelagic, demersal, resident, highly migratory, and anadromous species). In this region, fish distribution is largely influenced by seasonal temperature fluctuations. Various species use the geographic analysis area for feeding, development, reproduction, and nursery habitat (NEFSC 2020).

Many species of finfish belonging to pelagic, demersal, resident, or highly migratory assemblages occur in the geographic analysis area, suggesting that these species could potentially occur in or pass through the Project area. Moreover, a number of the species with potential to occur in the Project area have designated EFH either in or in the vicinity of the Project area (COP Appendix N; SouthCoast Wind 2024). For a list of species with EFH designations, see Appendix B, *Supplemental Information and Additional Figures and Tables*, of this EIS. In addition to those species with designated EFH, several species of commercial and recreational importance would be expected to occur in the geographic analysis area and Project area, which are discussed in further detail in Section 3.6.1.

Pelagic finfish species spend most of their lives swimming in the water column rather than occurring on or near the seafloor (NEFSC 2020). Pelagic species migrate north and south along the Atlantic Coast, depending on sea surface temperatures. They use the highly productive coastal waters during the summer months for feeding and then move to waters that are deeper, more distant, or both for the remainder of the year. Common species of this assemblage include Atlantic herring and Atlantic mackerel. Coastal pelagic species also rely on coastal wetlands, seagrass habitats, and estuaries to provide habitat for their early life stages. Demersal fish, or groundfish, are finfish species that inhabit benthic or benthopelagic (near-benthic) habitats. Common species of this assemblage include skates, summer flounder, and black sea bass. Many demersal finfish species have either pelagic eggs or larvae that are carried long distances by oceanic surface currents or eggs that adhere to the various benthic substrates. Highly migratory finfish species often migrate from southern portions of the Atlantic Ocean to as far north as the Gulf of Maine and are expected to be present in the Offshore Project area during the warmer summer months. Common species of this assemblage include tunas, sharks, and billfishes. Based on bottom trawl surveys conducted by NMFS NEFSC, the Massachusetts/Rhode Island offshore wind lease areas have low finfish biomass but high species richness when compared to neighboring waters around Cape Cod (COP Volume 2, Section 6.7.2, Figure 6-34 through Figure 6-37; SouthCoast Wind 2024).

Finfish species are also characterized as either estuarine, marine, or anadromous. Estuarine species generally reside in nearshore areas where waters have lower salinity levels than ocean waters (e.g., where rivers meet the ocean) and include species such as white perch (*Morone americana*). Marine finfish species are found offshore in deeper waters and utilize the open water column. Examples of marine finfish include Atlantic menhaden (*Brevoortia tyrannus*) and Atlantic herring (*Clupea harengus*). Anadromous fish species prefer both nearshore and offshore waters but annually migrate up rivers to lower-salinity environments for spawning. Juvenile anadromous species leave coastal rivers and estuaries to enter the ocean, where they grow to sexual maturity prior to returning to freshwater environments for spawning. Several species of anadromous fish are present in the geographic analysis area and thus could occur in the Project area. These include the American shad, alewife, and striped bass. In addition to estuarine, marine, and anadromous fish species, the less-common catadromous species, which are fish species that behave in the opposite fashion of anadromous fish, with adults migrating from fresh water to spawn in the sea, such as the American eel (*Anguilla rostrata*), are known to occur in coastal river systems along the east coast of North America and make their way to the Atlantic Ocean to spawn.

BOEM has funded several studies of finfish species occurrence in the northeast wind lease areas, which are summarized by Guida et al. (2017). The Mid-Atlantic Bight region contains some of the most productive fishing areas along the East Coast of the United States, largely due to the diversity and density of finfish that occur in the region (NJDEP 2010). The NMFS, Massachusetts Division of Marine Fisheries, Rhode Island Department of Environmental Management, and Northeast Area Monitoring and Assessment Program all have seasonal trawl surveys that sample finfish in the Project area. Data from these surveys are considered for use in stock assessments of state- and federally managed species. Stock assessments for federally managed species potentially affected by the Project can be found on NMFS' Stock Status, Management, Assessment, and Resource Trends website (NMFS 2022a) and NMFS' NEFSC Stock Assessment Review Index website (NEFSC 2022), and summaries are provided in the EFH Assessment (COP Appendix N; SouthCoast Wind 2024). Stock assessments for each Atlantic States Marine Fisheries Commission (ASMFC)–managed species can be found on ASMFC's website (ASMFC 2022). State-managed and federally managed fishes in the LME that have EFH in the Project area (COP Volume 2, Section 6.7.2.2.1, Table 6-49 through Table 6-51) or recorded catch in (COP Appendix V, Section 2.2, Table 2-5; SouthCoast Wind 2024) or in and around (COP Appendix V, Section 2.1, Table 2-1; SouthCoast Wind 2024) the Project area are listed in in Appendix B, *Supplemental Information and Additional Figures and Tables*. Many of these species can be found in the Project area throughout multiple life stages (i.e., eggs, larvae, juvenile, adult). The commercial importance of species is discussed in Section 3.6.1, and a record of species catch in the Project area is in COP Appendix V, Section 2.2, Table 2-5 (SouthCoast Wind 2024).

The outlook for finfish species throughout the geographic analysis area includes presumed increased anthropogenic pressure as human population size along the northeastern seaboard increases (NEFSC Ecosystem Assessment Program 2012), continued commercial and recreational fishing, and changing climate. Species-selective harvesting has led to shifts in fish community composition, with dominant populations comprising larger proportions of small pelagic fish, skates, and small sharks, which are of relatively low economic value (NOAA 2009). Currently, at the ecosystem level, the Georges Bank and the Mid-Atlantic Bight ecosystems that the Project area overlaps are not experiencing overfishing (NMFS 2021a, 2021b). Warming of coastal and shelf waters is resulting in a northward shift in the distributions of some fish species that prefer cooler waters; based on future increases in surface water temperatures, it is expected that this trend will continue (Morley et al. 2018; NEFSC Ecosystem Assessment Program 2012). Distributions are expected to contract in some species, while other species are expected to see range expansions under warmer conditions. A small number of species, such as longfin inshore squid (*Doryteuthis pealeii*), butterfish (*Peprilus triacanthus*), and black sea bass (*Centropristis striata*), have seen positive impacts on their productivity and distribution due to warming conditions, and Atlantic croaker (*Micropogonias undulates*) is one of the species expected to expand its range into the region. While these species stand to gain from warming temperatures, a greater number of species in the region are expected to see negative impacts on their productivity and distribution. Species such as the yellowtail flounder (*Limanda ferruginea*) have already experienced declines in productivity due to environmental changes, and species such as the Atlantic mackerel (*Scomber scombrus*) are expected to have their distribution shift out of the region (Hare et al. 2016). Trends of fish populations shifting toward the northeast and generally into deeper waters alter both species interactions and fishery interactions (Hare et al. 2016; NMFS 2021a, 2021b). Recent habitat climate vulnerability analyses link black sea bass, scup, and summer flounder to several highly vulnerable nearshore habitats, including estuarine systems, suggesting that populations are facing additional pressures that could lead to further population decline (Hare et al. 2016; NMFS 2021a, 2021b). Multiple drivers interact with each fish species differently; however, underlying climate change is likely linked to these changes. Most notably, fishes such as striped bass and flounder species may be affected due to increased predation levels at early life stages, where warmer than average winters may be affecting fishery resources during critical life stages. Striped bass surveys suggest recruitment success has decreased dramatically relative to the long-term average. Low recruitment could be caused by a mismatch in striped bass larval and prey abundance as a result of warm winter conditions, leading to decreased larval survival rates (NMFS 2021a). Moreover, warm winters trigger early phytoplankton and zooplankton blooms, resulting in timing mismatches between juvenile striped bass and key prey species (NMFS 2021a).

The Project area includes a portion of Nantucket and Rhode Island Sounds, which serve as a nursery habitat for some juvenile fishes, and Narragansett Bay, which is a regionally important estuary providing unique and diverse habitats, especially for early life stage development and survival. In the Sakonnet River/Mount Hope Bay portion of the Narragansett Bay, there has been a recent community shift from year-round resident species to summer migrants (e.g., summer flounder, black sea bass, scup, and butterfish) (SouthCoast Wind 2024). The phenology of finfish assemblages in Narragansett Bay has been driven by climate change with warm-water species residing longer as warm seasons have expanded (Langan et al. 2021). This pattern is expected to continue with further climate change.

Several ESA-listed species may occur in the geographic analysis area, including all five distinct population segments (DPS) (The Gulf of Maine, the New York Bight, the Chesapeake Bay, The Carolinas, and the

South Atlantic DPS) of Atlantic sturgeon (*Acipenser oxyrinchus*) (NMFS 2022b), shortnose sturgeon (*Acipenser brevirostrum*) (SSSRT 2010), giant manta ray (*Manta briostris*) (NMFS 2017a), Gulf of Maine distinct population segment of Atlantic salmon (*Salmo salar*) (NMFS 2020a), and oceanic whitetip shark (*Carcharhinus longimanus*) (NMFS 2017b).

The species with the greatest probability of occurring in the Offshore Project area, which includes the Lease Area and offshore and inshore ECCs, is the Atlantic sturgeon; however, occurrence would be rare, especially in the Lease Area (Stein et al. 2004; Eyler et al. 2009; Dunton et al. 2010; Erickson et al. 2011). The greatest probability of occurrence would be along the ECCs, particularly the Brayton Point ECC, and along the Sakonnet River (Stein et al. 2004). Otherwise, Atlantic sturgeon may be encountered by vessels transiting to and from ports, with potential port locations for the Proposed Action extending from Nova Scotia to South Carolina. Juvenile and adult Atlantic sturgeon occur in the offshore marine environment during fall, winter, and summer (Stein et al. 2004). Atlantic sturgeon have not been documented to spawn in tributaries between the Delaware and Hudson Rivers (Hilton et al. 2016). Atlantic sturgeon enter Chesapeake Bay in July and continue migrating into the James, York, and Pamunkey Rivers in Virginia to spawn in September (Hager et al. 2020, 2014; Kahn et al. 2014; Balazik et al. 2012). The only potential Project ports that are located within or close to designated Atlantic sturgeon critical habitat are the Port of Charleston (Cooper River) in South Carolina and Sparrows Point Port (Potomac River) in Maryland. However, the majority of Cooper River is upriver of the Port of Charleston and the mouth of the Potomac River is downriver of Sparrows Point Port. Impacts on any relevant physical and biological features of the designated critical habitat of the Carolina and Chesapeake Bay distinct population segments of Atlantic sturgeon are not anticipated to occur during transits of vessels or the transport of components during the construction phase of the Project.

The shortnose sturgeon (*Acipenser brevirostrum*) is found mainly in large freshwater rivers and coastal estuaries located along the east coast of North America, from New Brunswick to Florida. Based on its habitat preferences, shortnose sturgeon may occur in the nearshore ECCs and landfall locations (SouthCoast Wind 2024). However, shortnose sturgeon rarely leave their natal rivers (Bemis and Kynard 1997; Zydlewski et al. 2011). The Hudson River population is almost exclusively confined to the river (Kynard et al. 2016; Pendleton et al. 2018), differing from other populations that may use coastal waters to move into smaller coastal rivers nearby. None of the primary ports being considered for Proposed Action are along the Hudson River. In Mount Hope Bay and the Taunton River, a survey conducted by Buerkett and Kynard (1993) found that shortnose sturgeon was not present in this river system. In Chesapeake Bay, shortnose sturgeon primarily inhabit the Potomac and Susquehanna Rivers (NMFS 2024). The mouth of the Potomac River is downriver of Sparrows Point Port in Maryland while the mouth of the Susquehanna River is upriver of Sparrows Point Port.

Atlantic salmon are unlikely to occur in the Offshore Project area. Endangered Atlantic salmon from the Maine DPS, are not expected to occur south of central New England and the natural spawning population in North America occurs primarily between West Greenland and the Labrador Sea (Rikardsen et al. 2021; USASAC 2020). However, the DPS of Atlantic salmon could be affected by vessels transiting from the Port of Sheet Harbour in Nova Scotia, Canada; while it is noted that vessel strikes are not an identified threat to the species (74 FR 29344) or their recovery (USFWS and NMFS 2019), accidental releases or vessel noise could temporarily affect Atlantic salmon.

The giant manta ray (*Manta birostris*) is listed as threatened throughout its range (NMFS 2017a). This highly migratory species is found in temperate, subtropical, and tropical oceans worldwide. Sightings of giant manta rays in New England are rare, though individuals have been documented as far north as New Jersey and Block Island (BOEM 2021 citing Gudger 1922; BOEM 2021 citing Miller and Klimovich 2017; Farmer et al. 2022). In sightings compiled from 1925 to 2020 by Farmer et al. (2022), all sightings of giant manta rays, north of New Jersey, occurred along the boundary of the Atlantic OCS. Giant manta rays may overlap in areas traversed by vessels from New Jersey and farther south, however, interactions between transiting vessels and giant manta ray would be unlikely.

The oceanic whitetip shark (*Carcharhinus longimanus*) is listed as threatened throughout its range (NMFS 2017b). This species is generally found in tropical and subtropical oceans worldwide, inhabiting deep, offshore waters on the outer edge of the OCS (Young and Carlson 2020). In the western Atlantic, oceanic whitetips occur as far north as Maine (NMFS 2016). Given the species' preference for deep, offshore waters, it is possible, but unlikely that they would transit through the Offshore Project area. Similar to the other listed species, Oceanic whitetips may be affected by vessels transiting to and from ports. However, vessel strikes have not been identified as a threat to the species (NMFS 2016), and there is no information to indicate that vessels have adverse effects on this species (BOEM 2021).

Invertebrates

The geographic analysis area for invertebrates is the LME, which was selected based on the likelihood of encompassing most of the spatial range for most invertebrate species that would be expected to occur in the Project area. In this region, mobile invertebrate distribution is largely influenced by seasonal temperature fluctuations. Many species of invertebrates belonging to pelagic, demersal, and resident assemblages occur in the geographic analysis area, suggesting that these species could occur in or pass through the Project area. Moreover, a number of species with the potential to occur in the Project area have designated EFH either in or in the vicinity of the Project area (COP Appendix N; SouthCoast Wind 2024). In addition, several species of commercial and recreational importance would be expected to occur in the geographic analysis area and Project area, which is discussed in further detail in Section 3.6.1.

Invertebrate resources assessed in this section include the invertebrate zooplankton community and important megafauna species that have benthic, demersal, or planktonic life stages. Macrofaunal and meiofaunal invertebrates associated with benthic resources are assessed in Section 3.5.2. The description of invertebrate resources is supported by studies conducted by SouthCoast Wind (COP Appendix M; SouthCoast Wind 2024) as well as other studies reviewed in the literature. Benthic invertebrates in the geographic analysis area include polychaetes, crustaceans (e.g., amphipods, crabs, lobsters), mollusks (e.g., gastropods, bivalves), echinoderms (e.g., sand dollars, brittle stars, sea cucumbers), and various other groups (e.g., sea squirts, burrowing anemones) (Guida et al. 2017).

Zooplankton

Zooplankton are a type of heterotrophic plankton in the marine environment that range from microscopic organisms to large species, such as jellyfish. These invertebrates and early life vertebrates (e.g., ichthyoplankton) play an important role in marine food webs and include both organisms that spend their whole life cycles in the water column and those that spend only certain life stages (larvae) in the water column (e.g., meroplankton). In the marine environment, zooplankton dispersion patterns vary on a large spatial scale (from meters to thousands of kilometers) and over time (hours to years). Zooplankton can exhibit diel vertical migrations up to hundreds of meters; however, horizontal large-scale distributions over long distances are dependent on ocean currents and the suitability of prevailing hydrographic regimes. Historical information is available for zooplankton in the vicinity of the Offshore Project area, along with information from ongoing data collection surveys (e.g., the NEFSC Ecosystem Monitoring program surveys of the OCS and slope of the northeastern United States; that is, the Mid-Atlantic Bight, southern New England, Georges Bank, and the Gulf of Maine).

Zooplankton productivity, spatial distribution, and species composition are regulated by seasonal water changes. In the Mid-Atlantic Bight, strong seasonal patterns with increased zooplankton biomass are observed in spring in the upper few hundred meters of the water column (NJDEP 2010). Maximum abundance tends to occur between April and May on the OCS and in August and September on the inner shelf. The lowest zooplankton densities occur in February (NJDEP 2010). Thermal stratification is seasonal, and, when it breaks down, nutrients are released to the surface waters, driving seasonal patterns of abundance. High productivity is typical of the Northeast Continental Shelf LME, but productivity varies both spatially and seasonally. Large seasonal changes in water temperature occur in the Project area with influences from the Gulf Stream and ocean circulation patterns, which strongly regulate the productivity, species composition, and spatial distribution of zooplankton (NJDEP 2010). In 2021, for example, increasing zooplankton diversity in the Mid-Atlantic Bight was attributed to the declining dominance of a calanoid copepod (*C. typicus*), while the zooplankton community maintained a similar composition of other species (NMFS 2021a). The temporal and spatial patterns of *Calanus* copepods (zooplankton) have been linked to the phases of the North Atlantic Oscillation, which has a direct effect on the position and strength of important North Atlantic Ocean currents (Fromentin and Planque 1996; Taylor and Stephens 1998).

Narragansett Bay also has seasonal zooplankton abundance trends with peak abundance during spring and summer (Beaulieu et al. 2013). Predator-prey dynamics also influence zooplankton abundances in Narragansett Bay. Monitoring has observed changes in predator-prey overlap for two species of zooplankton in response to climate change (Costello et al. 2006).

Megafaunal Invertebrates

Stock assessments for each ASMFC-managed invertebrate species can be found on ASMFC’s website (ASMFC 2022). State- and federally managed invertebrates in the LME that have EFH in the Project area (COP Volume 2, Section 6.7.3.1, Table 6-52; SouthCoast Wind 2024) or recorded catch in (COP Appendix V, Section 2.2, Table 2-5; SouthCoast Wind 2024) or in and around (COP Appendix V, Section 2.1, Table

2-1; SouthCoast Wind 2024) the Project area include: American lobster (*Homarus americanus*), Atlantic sea scallop (*Placopecten magellanicus*), Atlantic surfclam (*Spisula solidissima*), horseshoe crab (*Limulus polyphemus*), Jonah crab (*Cancer borealis*), longfin inshore squid (*Loligo pealeii*), northern shortfin squid (*Illex illecebrosus*), northern shrimp (*Pandalus borealis*), ocean quahog (*Arctica islandica*), and Atlantic deep-sea red crab (*Chaceon quinquedens*).

Notable seasonal temperature changes in the Northeast Continental Shelf LME influence the distribution and movement of invertebrates with latitudinal (north–south) seasonal migrations and longitudinal (inshore–offshore) seasonal migrations (NJDEP 2010). Some megafaunal invertebrates found in the geographic analysis area are migratory (e.g., American lobster, Jonah crab, longfin inshore squid, and northern shortfin squid). Highly mobile invertebrates with broad habitat requirements have more flexibility to respond to disturbance and anthropogenic impacts compared to other invertebrates that are more sensitive because they have limited mobility or require specific habitats during one or more life stages. Species that are sessile or have more limited mobility, meaning they would be expected to reside in the Project area, include species such as Atlantic sea scallop, Atlantic surfclam, and ocean quahog, which were identified as shellfish species of concern for the Massachusetts offshore wind lease area by Guida et al. (2017). NEFSC seasonal trawl survey catches in the Massachusetts offshore wind lease area between 2003 and 2016 found that longfin squid were one of the dominant species in the warm season, along with some finfish species. In the cold season, no invertebrate species were dominant (Guida et al. 2017).

The Lease Area and the southern sections of the export cable corridors are predominantly characterized by soft-sediment habitats (NBEP 2017; COP Appendix M; SouthCoast Wind 2024). Economically and ecologically important species associated with soft sediments in the vicinity of the Project area include Atlantic sea scallop, bay scallop (*Argopecten irradians*), horseshoe crab, Atlantic surfclam, squid, Atlantic deep-sea red crab, channeled whelk, razor clam (*Ensis leei*), soft-shelled clam (*Mya arenaria*), northern quahog (*Mercenaria mercenaria*), and ocean quahog (COP Volume 2, Section 6.7.3; SouthCoast Wind 2024). Other soft-sediment megafaunal invertebrates include decapod crab species, sand dollars, sea stars, gastropods, and sea urchins (SouthCoast Wind 2024).

The northern section of the Falmouth ECC and the glacial moraines in the offshore portion of the Brayton Point ECC contain hard, complex habitats with attached epifauna and mobile epifauna such as whelk.[2] Hard substrates provide important nursery habitat for juvenile lobster and areas where squid species can attach egg masses, called mops (NJDEP 2010). Both squid and American lobster are of economic importance. The commercial importance of other species, such as Jonah crab (*Cancer borealis*), has increased with the decline of the American lobster fishery. Jonah crabs are typically associated with rocky habitats and soft sediment, while lobsters prefer hard-bottom habitats. Invertebrates associated with the presence of SAV occur in the northern portion of both export cable corridors (COP Appendix K; SouthCoast Wind 2024). The hard substrates, along with SAV, are EFH for the

---

[2] As described in Chapter 2, Section 2.1.2, *Alternative B – Proposed Action*, Brayton Point is the preferred ECC for both Project 1 and Project 2, and Falmouth is the variant ECC for Project 2, which would be used if SouthCoast Wind is prevented from using Brayton Point for Project 2.

spat (i.e., free-moving larvae) life stage of Atlantic sea scallop, which attach to these surfaces for survival (NEFMC and NMFS 2017), as do bay scallops.

The outlook for invertebrate species throughout the geographic analysis area includes presumed increased anthropogenic pressure as human population size along the northeastern seaboard increases (NEFSC Ecosystem Assessment Program 2012), continued commercial and recreational fishing, and changing climate. Warming of coastal and shelf waters is resulting in a northward shift in the distributions of some invertebrate species that prefer cooler waters; based on future increases in surface water temperatures, it is expected that this trend will continue (NEFSC Ecosystem Assessment Program 2012). American lobster distributions are a dramatic example of invertebrate distributions shifting toward the northeast and generally into deeper waters with more than a 70 percent decline in landings in southern New England between 1996 and 2014 and evidence of receding nursery habitat in Narragansett Bay (NOAA 2021; Wahle et al. 2015).

The Project area includes a portion of Nantucket and Rhode Island Sounds and Narragansett Bay, which provide unique and diverse habitats, especially for early life stage development and survival. The phenology of longfin squid in Narragansett Bay has been driven by climate change with this warm-water species residing longer as warm seasons have expanded (Langan et al. 2021). This pattern is expected to continue with further climate change with likely opposite effects for cold-water species (Langan et al. 2021).

Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act requires federal agencies to consult with NMFS on activities that could adversely affect EFH. NOAA defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (NOAA 2004, 2013). NMFS, the Northeast Fisheries Management Council, and the Mid-Atlantic Fisheries Management Council have defined EFH for various species in the northeastern United States offshore and nearshore coastal waters. EFH designations have been described based on 10-by 10-foot (3-by 3-meter) squares of latitude and longitude along the coast. The majority of EFH for species occurring in the waters of the New England and Mid-Atlantic OCS and nearshore coastal waters is managed under federal Fishery Management Plans developed by the New England Fishery Management Council and Mid-Atlantic Fishery Management Council (NEFMC 2021; MAFMC 2020). In addition to these species, several highly migratory species managed through a Fishery Management Plan developed by NMFS (2021c) are known or likely to occur in the geographic analysis area.

EFH has been designated for 46 species or management groups that occur in the New England and Mid-Atlantic OCS and nearshore coastal waters. Species and their EFH occurrence within the Project area are described in Table 3.5.5-1. The table also shows stock status and trends and spawning stock biomass.

Table 3.5.5-1. EFH in Project area and stock status for species in the New England and Mid-Atlantic OCS and nearshore coastal water

Species	EFH Occurrence in Project Area	Stock Status	Harvest Trend	10 Year Stock Trend	Spawning Stock Biomass (metric tons)	Report Year
Albacore Tuna	• EFH for juvenile and adult life stages in the Lease Area, Falmouth export cable corridor, and offshore portion of the Brayton Point export cable corridor • EFH for juvenile life stage only in Sakonnet River/Mount Hope Bay portion of the Brayton Point export cable corridor	Not overfished	Not subject to overfishing	Increasing	NA	2020
American Plaice	• Larval life stage EFH in the Lease Area	Not overfished	Not subject to overfishing	Decreasing	17,748	2019
Atlantic Butterfish	• EFH for all life stages in the Lease Area, Falmouth export cable corridor, offshore portion of the Brayton Point export cable corridor, and Sakonnet River/Mount Hope Bay portion of the Brayton Point export cable corridor • EFH for juvenile and adult life stages only at the Falmouth landfalls	Not overfished	Not subject to overfishing	Increasing	66,566	2022
Atlantic Cod	• EFH for all life stages in the Lease Area, Falmouth export cable corridor, offshore portion of the Brayton Point export cable corridor, and Sakonnet River/Mount Hope Bay portion of the Brayton Point export cable corridor • EFH for egg, larval, and juvenile life stages only at the Falmouth landfalls	Overfished (GB; GOM)	Overfishing is occurring (GB; GOM)	Decreasing (GB; GOM)	NA (GB); 3,083–3,223 (GOM, 2019)	2021
Atlantic Herring	• EFH for all life stages in the Lease Area, Falmouth export cable corridor, and offshore portion of the Brayton Point export cable corridor • EFH for larval, juvenile, and adult life stages only in Sakonnet River/Mount Hope Bay portion of the Brayton Point export cable corridor • EFH for juvenile life stage only at Falmouth landfalls	Overfished	Not subject to overfishing	Decreasing	39,091	2022

Species	EFH Occurrence in Project Area	Stock Status	Harvest Trend	10 Year Stock Trend	Spawning Stock Biomass (metric tons)	Report Year
Atlantic Mackerel	• EFH for all life stages in the Lease Area and Sakonnet River/Mount Hope Bay portion of the Brayton Point export cable corridor • EFH for egg, larval, and juvenile life stages only in Falmouth export cable corridor and offshore portion of the Brayton Point export cable corridor • EFH for juvenile life stage only in Falmouth landfall	Overfished	Overfishing is occurring	No Change	42,862	2021
Atlantic Sea Scallop	• Egg, larval, juvenile, and adult life stage EFH in the Lease Area, Falmouth export cable corridor, offshore portion of the Brayton Point export cable corridor, and Sakonnet River/Mount Hope Bay portion of the Brayton Point export cable corridor	Not overfished	Not subject to overfishing	Increasing	147,073	2020
Atlantic Surfclam	• Juvenile and adult life stage EFH in the offshore portion of the Brayton Point export cable corridor, Sakonnet River/Mount Hope Bay portion of the Brayton Point export cable corridor, Falmouth export cable corridor, and near the Falmouth landfalls	Not overfished	Not subject to overfishing	No Change	46,355,000	2016
Atlantic Wolffish	• EFH for all life stages in the offshore portion of the Brayton Point export cable corridor, Falmouth export cable corridor, and at Falmouth landfalls	Overfished	Not subject to overfishing	Increasing	676	2020
Barndoor Skate	• Juvenile and adult life stage EFH in the Lease Area	Not overfished	Not subject to overfishing	Increasing	NA	2020
Basking Shark	• EFH for all life stages in the Lease Area, offshore portion of the Brayton Point export cable corridor, Sakonnet River/Mount Hope Bay portion of the Brayton Point export cable corridor, and Falmouth export cable corridor	Unknown	Unknown	NA	NA	NA
Black Sea Bass	• EFH for juvenile and adult life stages in the Falmouth export cable corridor, Falmouth landfall, offshore portion of the Brayton Point export cable corridor, and Sakonnet River/Mount Hope Bay portion of the Brayton Point export cable corridor • EFH for juvenile life stage only in the Lease Area	Not overfished	Not subject to overfishing	Increasing	29,769	2021

Species	EFH Occurrence in Project Area	Stock Status	Harvest Trend	10 Year Stock Trend	Spawning Stock Biomass (metric tons)	Report Year
Blue Shark	• Neonate, juvenile, and adult life stage EFH in the Lease Area, Falmouth export cable corridor, and offshore portion of the Brayton Point export cable corridor	Not overfished	Not subject to overfishing	NA	NA	2015
Bluefin Tuna	• Juvenile and adult life stage EFH in the Lease Area, Falmouth export cable corridor, Falmouth landfalls, offshore portion of the Brayton Point export cable corridor, and Sakonnet River/Mount Hope Bay portion of the Brayton Point export cable corridor	Unknown	Not subject to overfishing	NA	NA	2017
Bluefish	• EFH for juvenile and adult life stages in the offshore portion of the Brayton Point export cable corridor and Sakonnet River/Mount Hope Bay portion of the Brayton Point export cable corridor • EFH for adult life stage only in the Lease Area and Falmouth export cable corridor	Not overfished	Not subject to overfishing	Decreasing	95,742	2021
Common Thresher Shark	• EFH for all life stages in the Lease Area, offshore portion of the Brayton Point export cable corridor, Sakonnet River/Mount Hope Bay portion of the Brayton Point export cable corridor, Falmouth export cable corridor, and Falmouth landfalls	Unknown	Unknown	NA	NA	NA
Dusky Shark	• EFH for all life stages in the Lease Area, Falmouth export cable corridor, and offshore portion of the Brayton Point export cable corridor	Overfished	Overfishing is occurring	NA	NA	2016
Haddock	• EFH for all life stages in Lease Area • EFH for egg, larval, and juvenile life stages only in the offshore portion of the Brayton Point export cable corridor and Sakonnet River/Mount Hope Bay portion of the Brayton Point export cable corridor • EFH for egg life stage only in the Falmouth export cable corridor	Not overfished (GB; GOM)	Not subject to overfishing (GB); overfishing is occurring (GOM)	NA (GB; GOM)	79,513 (GB, 2021); 16,528 (GOM, 2021)	2022
Little Skate	• Juvenile and adult life stage EFH in the Lease Area, offshore portion of the Brayton Point export cable corridor, Sakonnet River/Mount Hope Bay portion of the Brayton Point export cable corridor, Falmouth export cable corridor, and Falmouth landfalls	Not overfished	Not subject to overfishing	Decreasing	NA	2020

Species	EFH Occurrence in Project Area	Stock Status	Harvest Trend	10 Year Stock Trend	Spawning Stock Biomass (metric tons)	Report Year
Longfin Inshore Squid	• EFH for all life stages in the Lease Area, offshore portion of the Brayton Point export cable corridor, Sakonnet River/Mount Hope Bay portion of the Brayton Point export cable corridor, Falmouth export cable corridor, and near the Falmouth landfalls	Not overfished	Unknown	No Change	NA	2017
Monkfish	• EFH for all life stages in the Lease Area and offshore portion of the Brayton Point export cable corridor • EFH for egg and larval life stages only in the Falmouth export cable corridor	Unknown (GOM; MA)	Unknown (GOM; MA)	NA (GOM; MA)	NA (GOM; MA)	2022
Northern Shortfin Squid	• Adult life stage EFH in the offshore portion of the Brayton Point export cable corridor, Falmouth export cable corridor, and near the Falmouth landfalls	Unknown	Unknown	NA	NA	2022
Ocean Pout	• EFH for egg, juvenile, and adult life stages in the Falmouth export cable corridor, offshore portion of the Brayton Point export cable corridor, and Sakonnet River/Mount Hope Bay portion of the Brayton Point export cable corridor • EFH for egg and adult life stages only in the Lease Area	Overfished	Not subject to overfishing	No Change	NA	2017
Ocean Quahog	• Juvenile and adult life stage EFH in the Lease Area, offshore portion of the Brayton Point export cable corridor, and Falmouth export cable corridor	Not overfished	Not subject to overfishing	Increasing	NA	2017
Offshore Hake	• Larval life stage EFH in the Lease Area, Falmouth export cable corridor, and offshore portion of the Brayton Point export cable corridor	Not overfished	Unknown	NA	NA	2010
Pollock	• EFH for egg, larval, and juvenile life stages in the offshore portion of the Brayton Point export cable corridor • EFH for egg and larval life stages only in the Lease Area • EFH for larval life stage only in the Falmouth export cable corridor and Falmouth landfalls • EFH for juvenile life stage only in the Sakonnet River/Mount Hope Bay portion of the Brayton Point export cable corridor	Not overfished	Not subject to overfishing	NA	NA	2019

Species	EFH Occurrence in Project Area	Stock Status	Harvest Trend	10 Year Stock Trend	Spawning Stock Biomass (metric tons)	Report Year
Porbeagle Shark	• EFH for all life stages in the Lease Area	Overfished	Not subject to overfishing	NA	NA	2021
Red Hake	• EFH for all life stages in the Lease Area, Falmouth export cable corridor, offshore portion of the Brayton Point export cable corridor, and Sakonnet River/Mount Hope Bay portion of the Brayton Point export cable corridor • EFH for egg, larval, and juvenile life stages only at the Falmouth landfalls	Not overfished (GOM); Overfished (MA)	Not subject to overfishing (GOM); Overfishing is occurring (MA)	Increasing (GOM); Decreasing (MA)	NA (GOM; MA)	2017
Sand Tiger Shark	• Neonate and juvenile life stage EFH in the Lease Area, offshore portion of the Brayton Point export cable corridor, Sakonnet River/Mount Hope Bay portion of the Brayton Point export cable corridor, Falmouth export cable corridor, and Falmouth landfalls	Unknown	Unknown	NA	NA	NA
Sandbar Shark	• EFH for juvenile and adult life stages in the Lease Area, offshore portion of the Brayton Point export cable corridor, and Sakonnet River/Mount Hope Bay portion of the Brayton Point export cable corridor • EFH for juvenile life stage only in the Falmouth export cable corridor	Overfished	Not subject to overfishing	No Change	NA	2017
Scup	• EFH for all life stages in the Sakonnet River/Mount Hope Bay portion of the Brayton Point export cable corridor • EFH for juvenile and adult life stages only in the Lease Area, offshore portion of the Brayton Point export cable corridor, Falmouth export cable corridor, and Falmouth landfalls	Not overfished	Not subject to overfishing	Decreasing	176,404	2021
Shortfin Mako Shark	• Neonate, juvenile, and adult life stage EFH in the Lease Area, Falmouth export cable corridor, and offshore portion of the Brayton Point export cable corridor	Overfished	Overfishing is occurring	NA	NA	2017

Species	EFH Occurrence in Project Area	Stock Status	Harvest Trend	10 Year Stock Trend	Spawning Stock Biomass (metric tons)	Report Year
Silver Hake	• EFH for all life stages in the Lease Area • EFH for egg, larval, and adult life stages only in the offshore portion of the Brayton Point export cable corridor and Sakonnet River/Mount Hope Bay portion of the Brayton Point export cable corridor • EFH for egg and larval life stages only in the Falmouth export cable corridor and Falmouth landfalls	Not overfished (GM; MA)	Not subject to overfishing (GM; MA)	Increasing (GM; MA)	NA (GM; MA)	2020
Skipjack Tuna	• EFH for juvenile and adult life stages in the Lease Area, Falmouth export cable corridor, and offshore portion of the Brayton Point export cable corridor • EFH for adult life stage only at the Falmouth landfalls and the Sakonnet River/Mount Hope Bay portion of the Brayton Point export cable corridor	Not overfished	Unknown	NA	NA	2014
Smooth hound Shark Complex	• EFH for all life stages in the Lease Area, offshore portion of the Brayton Point export cable corridor, Sakonnet River/Mount Hope Bay portion of the Brayton Point export cable corridor, Falmouth export cable corridor, and Falmouth landfalls	Not overfished	Not subject to overfishing	NA	NA	2015
Spiny Dogfish	• Male and female sub-adult and adult life stage EFH in the Lease Area, offshore portion of the Brayton Point export cable corridor, and Falmouth export cable corridor • EFH for sub-adult female and adult male life stages only in the Sakonnet River/Mount Hope Bay portion of the Brayton Point export cable corridor	Not overfished	Not subject to overfishing	Decreasing	NA	2018
Summer Flounder	• EFH for all life stages in the Lease Area, offshore portion of the Brayton Point export cable corridor, Falmouth export cable corridor, and Falmouth landfall • EFH for larval, juvenile, and adult life stages only in the Sakonnet River/Mount Hope Bay portion of the export cable corridor	Not overfished	Not subject to overfishing	Decreasing	47,397	2021

Species	EFH Occurrence in Project Area	Stock Status	Harvest Trend	10 Year Stock Trend	Spawning Stock Biomass (metric tons)	Report Year
Tiger Shark	• Juvenile and adult life stage EFH in the Lease Area, Falmouth export cable corridor, and offshore portion of the Brayton Point export cable corridor	Unknown	Unknown	NA	NA	NA
White Hake	• EFH for juvenile and adult life stages only in the Lease Area • EFH for larval and juvenile life stages only in the Falmouth export cable corridor and offshore portion of the Brayton Point export cable corridor • EFH for juvenile life stage only at the Falmouth landfalls	Not overfished	Not subject to overfishing	Decreasing	NA	2017
White Shark	• EFH for all life stages in the Lease Area, offshore portion of the Brayton Point export cable corridor, Falmouth export cable corridor, and Falmouth landfalls • EFH for neonate life stage only in Sakonnet River/Mount Hope Bay portion of the Brayton Point export cable corridor	Unknown	Unknown	NA	NA	NA
Windowpane Flounder	• EFH for all life stages in the Lease Area, Falmouth export cable corridor, offshore portion of the Brayton Point export cable corridor, and Sakonnet River/Mount Hope Bay portion of the Brayton Point export cable corridor • EFH for juvenile and adult life stages only at the Falmouth landfalls	Not overfished	Not subject to overfishing	Increasing	NA	2017
Winter Flounder	• EFH for all life stages in the Falmouth export cable corridor, Falmouth landfall, and Sakonnet River/Mount Hope Bay portion of the Brayton Point export cable corridor • EFH for larval, juvenile, and adult life stages only in the Lease Area and offshore portion of the Brayton Point export cable corridor	Not overfished	Not subject to overfishing	Decreasing	3,353	2022
Winter Skate	• Juvenile and adult life stage EFH in the Lease Area, offshore portion of the Brayton Point export cable corridor, Sakonnet River/Mount Hope Bay portion of the Brayton Point export cable corridor, Falmouth export cable corridor, and Falmouth landfalls	Not overfished	Not subject to overfishing	No Change	NA	2020

Species	EFH Occurrence in Project Area	Stock Status	Harvest Trend	10 Year Stock Trend	Spawning Stock Biomass (metric tons)	Report Year
Witch Flounder	• EFH for all life stages in the Lease Area • EFH for egg, larval, and adult life stages only in the offshore portion of the Brayton Point export cable corridor • EFH for larval and adult life stages only in the Falmouth export cable corridor	Overfished	Unknown	Increasing	NA	2017
Yellowfin Tuna	• EFH for juvenile and adult life stages in the offshore portion of the Brayton Point export cable corridor • EFH for juvenile life stage only in the Lease Area, Falmouth export cable corridor, Falmouth landfalls, and Sakonnet River/Mount Hope Bay portion of the Brayton Point export cable corridor	Not overfished	Not subject to overfishing	NA	NA	2019
Yellowtail Flounder	• EFH for all life stages in the Lease Area, Falmouth export cable corridor, offshore portion of the Brayton Point export cable corridor, and Sakonnet River/Mount Hope Bay portion of the Brayton Point export cable corridor • EFH for juvenile life stage only at the Falmouth landfalls	Overfished (GB; SNE); not overfished (GOM)	Unknown (GB); not subject to overfishing (GOM; SNE)	Decreasing (GB; SNE); Increasing (GOM)	NA (GB); 3,058 (GOM, 2021); 70 (SNE, 2021)	2022

Stock status is determined as “overfished” if a stock’s biomass level is depleted to a degree that the stock's capacity to produce maximum sustainable yield is jeopardized.
Harvest Trend is determined to be “subject to overfishing” if the harvest rate is higher than the recruitment rate that produces maximum sustainable yield.
Source: NMFS 2022a
NA = not applicable; GB = Georges Bank stock; GOM = Gulf of Maine stock; SNE = Southern New England stock; MA = Mid-Atlantic stock

NOAA, the Northeast Fisheries Management Council, and the Mid-Atlantic Fisheries Management Council also identified an HAPC as a component of EFH. HAPCs are high-priority areas for conservation and exhibit one or more of the following characteristics: rare, sensitive, stressed by development, provide important ecological functions for federally managed species, or especially vulnerable to anthropogenic degradation. HAPCs can cover specific localities or cover habitat types that could be found at many locations (NOAA 2004). HAPCs that could be directly affected by Project activities include the summer flounder HAPC, juvenile Atlantic cod HAPC, and Southern New England HAPC specific to Atlantic cod spawning. The summer flounder HAPC includes all native species of macroalgae, seagrasses, and freshwater and tidal macrophytes (i.e., SAV) in any size bed, as well as loose aggregations, in currently designated adult and juvenile summer flounder EFH. Summer flounder HAPC overlaps the Project area at the Falmouth landfall sites (MAFMC 2016). The juvenile Atlantic cod HAPC includes inshore areas of the Gulf of Maine and southern New England between 0 to 65 feet (0 to 20 meters), relative to mean high water. The juvenile Atlantic cod HAPC overlaps the Project area in Mount Hope Bay, the Sakonnet River, and Nantucket Sound (NEFMC and NMFS 2017). Larval and young-of-the-year Atlantic cod have both been observed overlapping with the Project area in the Sakonnet River and Mount Hope Bay (Langan et al. 2019).

In October 2017, the New England Fishery Management Council established a new juvenile Atlantic cod HAPC for the New England coastline out to a depth of 66 feet (20 meters). NMFS implemented this HAPC on April 9, 2018. This HAPC for juvenile Atlantic cod is a subset of EFH for juvenile Atlantic cod, which consists of structurally complex habitats, including eelgrass, mixed sand and gravel, rocky habitats, and emergent epifauna (NEFMC and NMFS 2017). The HAPC for juvenile Atlantic cod includes all hard-bottom habitats within both ECCs and within 20 nautical miles of shore. The total area of juvenile Atlantic cod HAPC present in the ECCs is not known but is assumed to occur along the entire length of the ECCs from the 65.6-foot (20-meter) depth contour to shore. Overall, the proportion of juvenile cod HAPC within the ECCs is small considering the entire HAPC extends from the Canadian border to southern New England (map 245 in NEFMC and NMFS 2017).

Evidence of cod spawning has been observed in an area known as Cox Ledge, which lies on the northwest corner of the Massachusetts and Rhode Island wind energy areas (Van Hoeck et al. 2023). An HAPC framework adjustment for southern New England was proposed by the NEFMC for complex habitats and Atlantic cod spawning habitats, which could potentially overlap with the Project area (NEFMC 2023). Alternatives proposed under the Southern New England HAPC include designating cod spawning grounds on and surrounding Cox Ledge as a HAPC, designating the spawning grounds on and around Cox Ledge and any future cod spawning grounds identified in southern New England as HAPCs, designating all areas in southern New England with complex habitats as an HAPC, and designating the area overlapping offshore wind lease sites in Southern New England as an HAPC (NEFMC 2023). The spatial extent of the HAPC overlapping wind energy lease sites is based on the footprint of the lease areas, buffered by approximately 10 kilometers on all sides, combined with the footprint of the Cox Ledge spawning ground. The HAPC proposal emphasizes the importance of protecting high-value complex benthic habitats currently known to be used by Atlantic cod for spawning and other potentially suitable cod-spawning areas from the negative impacts associated with offshore development (NEFMC

2023). This proposed expansion is also in recognition of other EFH species that use complex habitat during their life history. The species noted in addition to Atlantic cod are Atlantic herring, Atlantic sea scallop, little skate, monkfish, ocean pout, red hake, winter flounder, and winter skate. The southern New England HAPC adjustments became effective on March 6, 2024 (NOAA 2024).

Geophysical surveys conducted by SouthCoast Wind mapped and characterized seafloor habitats in the Project area (COP Appendix M.3; SouthCoast Wind 2024). Habitat types within the Project area (**Error! Not a valid bookmark self-reference.**) that include EFH for managed species range from various sediment types and boulders to SAV and shell accumulations. The Lease Area is composed predominantly of mud to muddy sand while complex habitats can be found within sections of the ECCs. HAPC for juvenile Atlantic cod and summer flounder were also quantified within the Lease area and cable corridors (**Error! Not a valid bookmark self-reference.**). Benthic habitats found in the Falmouth ECC as it crosses the Muskeget Channel are mostly complex habitats consisting of coarse sediments and Glacial Moraine A (Table 3.5.5-3). In both the Mount Hope Bay (Table 3.5.5-4) and Sakonnet River (Table 3.5.5-5) segments of the Brayton Point ECC, sediments of sand or finer grain size are the dominant substrate types with a co-occurrence of *Crepidula* shell substrate.

Table 3.5.5-2. Area (acres) of different habitat types within Project components

Habitat Types	Lease Area	Falmouth ECC Route - Federal	Falmouth ECC Route – MA State Waters	Brayton Point ECC Route - Federal	Brayton Point ECC Route – RI State Waters
Glacial Moraine A	-	-	1,691	411	185
Bedrock	-	-	-	-	3
Gravel Pavement	-	-	1,818	-	-
Mixed-Size Gravel	-	-	-	18	510
Boulder Fields Present	-	2.6	544	945	184
Coarse Sediment	-	-	2,325	1,026	0.1
Mud to Muddy Sand	49,731	15	444	4,015	3,851
Sand	777	4,406	4,174	9,596	1,478
SAV	-	-	295	-	-
Shell Accumulations	-	-	1,531	-	1,342
Anthropogenic		-	-	-	7
HAPC	-	151	10,895	0	6,210

Source: COP Appendix M; SouthCoast Wind 2024.

Table 3.5.5-3. Area (acres) of different habitat components within the Muskeget Channel area of the Falmouth ECC

Habitat Types	Area (Acres)	Percentage of Area
Coarse Sediment	1,091	41.1%
Coarse Sediment - with Boulder Field(s)	22	0.8%
Glacial Moraine A	1,008	38.0%
Sand	516	19.4%
Sand - Mobile with Boulder Field(s)	19	0.7%
Sand - SAV	0.06	0.0%
Total	**2,657**	**100%**

Source: Mayflower Wind – Benthic Habitat Pop-up Mapper (INSPIRE 2022).

Table 3.5.5-4. Area (acres) of different habitat components within the Mount Hope Bay portion of the Brayton Point ECC

Habitat Types	Area (Acres)	Percentage of Area
Anthropogenic (dredged material deposit)	75	3.0%
Anthropogenic (rock rubble)	0	0.0%
Bedrock	2	0.1%
Coarse Sediment - with Boulder Field(s)	0	0.0%
Glacial Moraine A	19	0.7%
Mud to Muddy Sand	1,700	67.6%
Mud to Muddy Sand - (Likely) Crepidula Substrate with Boulder Field(s)	56	2.2%
Mud to Muddy Sand - Crepidula Substrate with Boulder Field(s)	4	0.2%
Mud to Muddy Sand - Shell / Crepidula Substrate	609	24.2%
Mud to Muddy Sand - with Boulder Field(s)	7	0.3%
Sand	42	1.7%
Total	**2,516**	**100%**

Source: Mayflower Wind – Benthic Habitat Pop-up Mapper (INSPIRE 2022).

Table 3.5.5-5. Area (acres) of different habitat components within the Sakonnet River portion of the Brayton Point ECC

Habitat Types	Area (Acres)	Percentage of Area
Anthropogenic (Rock Rubble)	4	0.1%
Anthropogenic (Rock Rubble/Trawl Marks)	3	0.1%
Mixed-Size Gravel in Muddy Sand to Sand	233	7.0%
Mud to Muddy Sand	1,632	48.9%
Mud to Muddy Sand - (Likely) Crepidula Substrate	37	1.1%
Mud to Muddy Sand - Crepidula Substrate	606	18.1%

Habitat Types	Area (Acres)	Percentage of Area
Mud to Muddy Sand - Mobile	29	0.9%
Mud to Muddy Sand - with SAV	4	0.1%
Sand	791	23.7%
Sand - with Boulder Field(s)	1	0%
Total	**3,340**	**100%**

Source: Mayflower Wind – Benthic Habitat Pop-up Mapper (INSPIRE 2022).

3.5.5.2 Impact Level Definitions for Finfish, Invertebrates, and Essential Fish Habitat

Impact level definitions are provided in **Error! Reference source not found.**.

Table 3.5.5-6. Definitions of impact levels for finfish, invertebrates, and essential fish habitat

Impact Level	Type of Impact	Definition
Negligible	Adverse	Impacts on species or habitat would be so small as to be unmeasurable.
	Beneficial	No effect or no measurable effect.
Minor	Adverse	Most impacts on species would be avoided; if impacts occur, they may result in the loss of a few individuals. Impacts on sensitive habitats would be avoided; impacts that do occur would be temporary or short term in nature.
	Beneficial	A small and measurable beneficial impact on a few individuals. Habitat benefits would be temporary or short term.
Moderate	Adverse	Impacts on species would be unavoidable but would not result in population-level effects. Impacts on habitat may be short term, long term, or permanent and may include impacts on sensitive habitats but would not result in population-level effects on species that rely on them.
	Beneficial	A notable and measurable beneficial impact on a larger number of individuals or multiple species but would not result in population-level effects. Habitat benefits would be short term, long term, or permanent.
Major	Adverse	Impacts would affect the viability of the population and would not be fully recoverable. Impacts on habitats would result in population-level impacts on species that rely on them.
	Beneficial	A regional or population-level beneficial impact on species or habitat.

3.5.5.3 Impacts of Alternative A – No Action on Finfish, Invertebrates, and Essential Fish Habitat

When analyzing the impacts of the No Action Alternative on finfish, invertebrates, and EFH, BOEM considered the impacts of ongoing activities, including ongoing non-offshore wind and ongoing offshore wind activities on the baseline conditions for finfish, invertebrates, and EFH. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities, as described in Appendix D*, Planned Activities Scenario*.

Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for finfish, invertebrates, and EFH, described in Section 3.5.5.1, *Description of the Affected Environment and Future Baseline Conditions,* would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities. Ongoing non-offshore wind activities in the geographic analysis area that contribute to impacts on finfish, invertebrates, and EFH are generally associated with commercial harvesting and fishing activities, UXO interaction, fisheries bycatch, regulated fishing effort, water quality degradation and pollution, effects on benthic habitat via dredging and bottom trawling, accidental fuel leaks or spills, and climate change.

Some mobile invertebrates can migrate long distances and encounter a wide range of stressors over broad geographical scales (e.g., longfin and shortfin squid). Their mobility and broad range of habitat requirements may also mean that limited disturbance may not have measurable effects on their stocks (populations). This would apply to finfish, where populations are composed largely of long-range migratory species; it would be expected that their mobility and broad ranges would preclude many temporary and short-term impacts associated with ongoing offshore impacts throughout the geographic analysis area. Invertebrates with more restricted geographical ranges or sessile invertebrates or life stages may be subject to these stressors for longer durations and can be more sensitive to temporary offshore disturbances (Guida et al. 2017).

Seafloor habitat is routinely disturbed through dredging (for navigation, marine minerals extraction, and military purposes) and commercial fishing use of bottom trawls and dredge-fishing methods. Ongoing dredging for the purposes of navigation and other ongoing activities results in short-term, localized impacts, such as habitat alteration and change in complexity, on finfish, invertebrates, and EFH. Sandy or silty habitats, which are abundant in the geographic analysis area, are quick to recover from dredging disturbance. According to Newcombe and MacDonald (1991), impacts from settlement of resuspended sediment plumes increase with the concentration of resuspension and the duration over which invertebrates are exposed to that plume. In general, sediment plumes are localized, which results in larger and coarser sediment falling out of the water column and settling on the seafloor in the area near or immediately adjacent to the activity, while smaller, fine sediments may remain suspended in the water column for a longer period before settling potentially at a greater distance from the disturbance.

UXO interactions would be expected to continue due to ongoing development of aquaculture, fishing, wind farms, power cables, and oil or gas pipeline development. Additionally, an increase in ship traffic, in general, would result in an overall increase in potential interactions with UXO and the associated corrosion of UXO, subsequent releases of their constituents to the marine environment, and adverse impacts on marine habitats. Therefore, the potential for disturbance, injury, or mortality to fish and loss of habitat would also persist.

Regulated fishing would continue to affect finfish, invertebrates, and EFH in the geographic analysis area by direct removal of resources (i.e., harvests) and gear impacts on habitats (e.g., bottom disturbance). Ongoing fisheries management practices are anticipated to have positive population-level impacts on managed species in the long term. Existing legislation requires federally managed species to achieve maximum sustainable yield, meaning federally managed species in the region would see restored population numbers under successful fisheries management. Abandoned or lost fishing gear remains in the aquatic environment for extended time periods, often entangling or trapping mobile invertebrate and fish species. Bycatch affects many species throughout the geographic analysis area, such as windowpane flounder, blueback herring, shark species, and hake species. Water quality impacts from ongoing onshore and offshore activities affect nearshore habitats, and accidental spills can occur from pipeline or marine shipping. Invasive species can be accidentally released in the discharge of ballast water and bilge water from marine vessels. The resulting impacts on invertebrates and finfish depend on many factors but can be widespread and permanent, especially if the invasive species becomes established and outcompetes native species.

Global climate change has the potential to affect the distribution and abundance of invertebrates and their food sources, primarily through increased water temperatures but also through changes to ocean currents and increased acidity. The northeast shelf has experienced increasingly elevated temperatures in both surface and bottom depths (NMFS 2021a, 2021b). Finfish and invertebrate migration patterns can be influenced by warmer waters, as can the frequency or magnitude of disease (Hare et al. 2016). Regional water temperatures that increasingly exceed the thermal stress threshold may affect the recovery of the American lobster fishery off the East Coast of the United States (Rheuban et al. 2017). Ocean acidification driven by climate change is contributing to reduced growth and, in some cases, decline of invertebrate species with calcareous shells. Increased freshwater input into nearshore estuarine habitats can result in water quality changes and subsequent effects on invertebrate species (Hare et al. 2016).

Based on a recent study, northeastern marine, estuarine, and riverine habitat types were found to be moderately to highly vulnerable to stressors resulting from climate change (Farr et al. 2021). In general, rocky and mud bottom, intertidal, SAV, kelp, coral, and sponge habitats were considered the most vulnerable habitats to climate change in marine ecosystems (Farr et al. 2021). Similarly, estuarine habitats considered most vulnerable to climate change include intertidal mud and rocky bottom, shellfish, kelp, SAV, and native wetland habitats (Farr et al. 2021). Riverine habitats found to be most vulnerable to climate change include native wetland, sandy bottom, water column, and SAV habitats (Farr et al. 2021). As invertebrate habitat, finfish habitat, and EFH may overlap with these habitat types, this study suggests that marine life and habitats could experience dramatic changes and decline over time as impacts from climate change continue.

The following ongoing offshore wind activities in the geographic analysis area contribute to impacts on finfish, invertebrates, and EFH.

- Continued O&M of three offshore wind projects:
  - Block Island project (five WTGs) installed in state waters.
  - South Fork Wind Farm Project (12 WTGs and 1 OSP) installed in OCS-A 0517.
  - CVOW-Pilot Project (two WTGs) installed in OCS-A 0497.

- Ongoing construction of eight offshore wind projects:
  - Vineyard Wind 1 Project (62 WTGs and 1 OSP) in OCS-A 0501.
  - Revolution Wind project (65 WTGs and two OSPs) in OCS-A 0486.
  - Sunrise Wind Project (94 WTGs and 1 OSP in OCS-A 0487.
  - New England Wind Project (128 WTGs and 2 OSPs) in OCS-A 0534 and a portion of OCS-A 0501.
  - Empire Wind (147 WTGs and 2 OSPs) in OCS-A 0512.
  - Ocean Wind 1 (98 WTGs and 3 OSPs) in OCS-A 0498.
  - Atlantic Shores South Project (195 WTGs and 2 OSPs) in OCS-A 0499.
  - CVOW-C Project (176 WTGs and 3 OSPs) in OCS-A 0483.

Ongoing O&M of the Block Island, South Fork Wind, and CVOW-Pilot projects and ongoing construction of multiple offshore wind projects would affect fish, invertebrates, and EFH through the primary IPFs of accidental releases, anchoring, discharges/intakes, EMF, lighting, cable emplacement and maintenance, noise, port utilization, and presence of structures. Ongoing offshore wind activities would have the same type of impacts that are described in *Cumulative Impacts of the No Action Alternative* for ongoing and planned offshore wind activities, but the impacts would be of lower intensity.

Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impact of the No Action Alternative in combination with other planned non-offshore wind activities and planned offshore wind activities (without the Proposed Action).

Planned non-offshore wind activities that may affect finfish, invertebrates, and EFH include new submarine cables and pipelines, tidal energy projects, marine minerals extraction, dredging, military use, marine transportation, and oil and gas activities (see Appendix D, *Planned Activities Scenario*, for a description of planned activities). Impacts from planned non-offshore wind activities would be similar to those from ongoing activities and may include temporary and permanent impacts on benthic resources from disturbance, injury, mortality, habitat degradation, and habitat conversion. While these impacts would have localized effects on finfish, invertebrates, and EFH, population-level effects would not be expected.

The following sections summarize the potential impacts of ongoing and planned offshore wind activities on finfish, invertebrates, and EFH during construction, O&M, and decommissioning of the projects. Planned offshore wind activities include offshore wind energy development activities on the Atlantic OCS other than the Proposed Action determined by BOEM to be reasonably foreseeable (see Attachment 2 in Appendix D for a complete description of planned offshore wind activities).

BOEM expects other offshore wind activities to affect finfish, invertebrates, and EFH through the following primary IPFs.

Accidental releases: Offshore wind energy development could result in the accidental release of contaminants or trash/debris that could affect water quality. The risk of any type of accidental release would increase, primarily during construction but also during operations and decommissioning of offshore wind facilities. Hazardous materials that could be released include coolant fluids, oils and lubricants, and diesel fuels and other petroleum products. These materials tend to float in seawater, so they are less likely to directly contact the benthic environment; however, zooplankton communities and planktonic stages of invertebrates would be more likely to be exposed. Accidental release in the water column could also affect finfish species through consumption of material and smothering, both of which could result in mortality. Accidental releases could thus potentially result in lethal or sublethal effects, particularly on finfish and invertebrates, especially sensitive life stages such as planktonic larvae and pelagic eggs. Any accidental releases are expected to be localized and subject to mitigation to minimize environmental impacts. In most cases, the corresponding impacts on benthic habitats are unlikely to be detectable unless there is a catastrophic spill (e.g., an accident involving a tanker ship) or the spill involves heavy fuel oil that would sink to the seabed and persist in the aquatic environment for a longer time period. Compliance with USCG regulations would minimize the risk of accidental release of trash or debris. Therefore, with mitigation measures in place, the total volume of contaminants and trash or debris from accidental releases would be negligible and not measurably contribute to potential adverse impacts in the geographic analysis area.

Another potential impact related to vessels and vessel traffic is the accidental release of invasive species, especially during ballast water and bilge water discharges from marine vessels. Increasing vessel traffic related to the offshore wind industry would increase the risk of accidental releases of invasive species, primarily during construction. 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 National Pollutant Discharge Elimination System Vessel General Permit standards, both of which aim at least in part to prevent the release and movement of invasive species. Adherence to these regulations would reduce the likelihood of discharge of ballast or bilge water contaminated with invasive species. Although the likelihood of invasive species becoming established due to offshore wind activities is low, the impacts of invasive species invertebrates could be strongly adverse, widespread, and permanent if the species were to become established and outcompete native fauna. The increase in this risk related to the offshore wind industry would be small in comparison to the risk from ongoing activities (e.g., transoceanic shipping).

The overall offshore wind impacts of accidental releases on finfish, invertebrates, and EFH are likely to be localized and short term, resulting in little change to these resources. As such, accidental releases from offshore wind development would not be expected to appreciably contribute to overall impacts on these resources, and impacts would be minor.

Anchoring: Offshore wind energy development would lead to increased vessel anchoring during survey activities and during the construction, installation, maintenance, and decommissioning of offshore components. In addition, anchoring/mooring of meteorological towers or buoys could be increased. Anchoring causes temporary disturbance to the seafloor, which would be considered temporary, short-term impacts that occur regularly throughout the geographic analysis area. These activities would increase turbidity and could result in direct mortality from physical contact for finfish and invertebrate resources and degradation of sensitive hard-bottom habitats, including EFH. Other offshore wind projects could disturb up to 6,708 acres (2,715 hectares) of seafloor habitat, increasing turbidity and potentially disturbing, displacing, or injuring benthic habitat, finfish, and invertebrates. This disturbance would be localized and temporary, representing considerably less than 1 percent of the total available benthic habitat in the geographic analysis area. Potential impacts would be minimized by the implementation of mitigation measures. For finfish specifically, it is unlikely that adult fish would be directly affected by anchoring, and impacts would be negligible. However, less-mobile life stages, such as eggs and larvae, could experience direct mortality or smothering from turbidity, with impacts occurring at a local, small scale, not at a population or species level, and they would be temporary, minor, and localized. It would be expected that recovery of any affected species would occur in the short term, although degradation of sensitive habitats could persist in the long term.

Physical seabed disturbance due to anchoring would generally result in localized and temporary impacts on invertebrate resources, with recovery in the short term. Mobile invertebrates would be temporarily displaced, whereas sessile and slow-moving invertebrates could be subject to localized lethal and sublethal impacts. Demersal eggs and larvae would be particularly vulnerable to sediment disturbance and resettlement. High rates of mortality can occur in longfin squid egg masses if exposed to abrasion (Steer and Moltschaniwskyj 2007). In contrast, if the anchoring activity leads to the restructuring of patchy cobble boulder habitat into more linear, continuous cobble habitat, the change may provide juvenile lobsters with higher-value small-scale habitat, where predation rates would be expected to be lower (Guarinello and Carey 2020).

Impacts would be expected to be localized, turbidity would be temporary, and mortality of sessile invertebrate and life stages from contact would be recovered in the short term. Degradation of sensitive habitats, such as eelgrass beds and hard-bottom habitats, if it occurs, could be long term to permanent. The overall impacts of anchoring on finfish, invertebrates, and EFH are likely to be moderate, localized, and short term.

Cable emplacement and maintenance: Cable emplacement and maintenance activities (including dredging) would disturb sediments and cause sediment suspension, which could disturb, displace, and directly injure finfish and invertebrate species and EFH. Seabed areas identified for cable emplacement are cleared of buried hazards by conducting a grapnel run. Larger boulders that cannot be avoided by rerouting are removed or relocated using a boulder plow. The intensity of impacts would depend on multiple factors, including time of year, sediment type, and habitat type being affected where activities occur. Short-term disturbance of seafloor habitats during grapnel runs, dredging, or the use of boulder plows could disturb, displace, and directly injure or result in mortality of invertebrates in the immediate vicinity of the cable-emplacement activities. Finfish that spawn in aggregations or close to the seabed may be vulnerable to direct impacts from cable emplacement activities, especially if those activities take place during spawning season.

Sand wave and smaller sand ripple clearance may be required to install cables at a sufficient depth that they would not be uncovered as a result of sand wave mobility. Larger-scale sand waves are considered to be more stable and permanent when compared with sand ripples, with associated slopes generally less than 1 degree, although vertical relief may be as much as 49 feet (15 meters). Cable emplacement and maintenance activities may flatten depressions and small sand waves, temporarily reducing benthic habitat suitability for species such as red and silver hake within the cable footprint. Prey organisms that use these habitats would also be displaced, potentially affecting habitat suitability for fish species. Trenching may leave behind temporary depressions. The extent of these natural features is difficult to quantify, as they are continually reshaped by natural sediment transport processes. Natural recovery from anthropogenic disturbance is likely to occur within several months of the disturbance, depending on timing relative to winter storm events. Due to their mobility, it is expected that the sand ripples would rapidly return after cable installation, while larger sand waves would take longer to reform.

Dredging activities result in plumes of sediments into the water column that will eventually settle on the seafloor. Additional activities such as trenching for new cables, as well as maintenance activities, also periodically disturb sediments. In general, sediment plumes are localized, which results in larger and coarser sediment falling out of the water column and settling on the seafloor in the area near or immediately adjacent to the activity, while smaller, fine sediments may remain suspended in the water column for a longer time period before settling potentially at a greater distance from the disturbance. In addition to dredging, pile-driving activities can produce sediment plumes that would result in sediment deposition and burial of invertebrates and non-motile organisms and life stages, such as benthic eggs and larvae.

Dredging and mechanical trenching used in the course of cable installation could cause localized, short-term impacts (habitat alteration, lethal and sublethal effects) on invertebrates through sediment deposition and seabed profile alterations. Sediment deposition could result in adverse impacts on invertebrates, including smothering. The tolerance of invertebrates to being covered by sediment (sedimentation) varies among species and life stage. Some sessile shellfish may only tolerate 0.4 to 0.8 inch (1 to 2 centimeters), while other benthic organisms can survive burial in upward of 7.9 inches (20 centimeters) (Essink 1999). Demersal eggs and larvae would be particularly vulnerable to sediment disturbance and resettlement. For example, high rates of mortality can occur in longfin squid egg masses if exposed to abrasion. For migratory invertebrate species, impacts would be expected to vary by time of year, based on the species' presence in the vicinity of the dredge area. Finfish are unlikely to be affected by sediment deposition or burial; however, sessile life stages of some finfish such as eggs and larvae could be smothered by sediments, causing mortality. Impacts would be expected to vary by time of year, based on when any finfish species may spawn.

When new cable emplacement and maintenance cause resuspension of sediments, increased turbidity could have an adverse impact on filter-feeding fauna such as bivalves. The impact of increased turbidity on invertebrates depends on both the concentration of suspended sediment and the duration of exposure. Plume modeling completed for other wind development projects in the region and with similar sediment characteristics (Vineyard Wind 1, Block Island Wind Farm, and Virginia Offshore Wind Technology Advancement) predict that suspended sediment would usually settle well before 12 hours have elapsed (TetraTech 2012; BOEM 2015). BOEM, therefore, expects relatively little impact from increased turbidity (separate from the impact of direct sediment deposition) due to cable-emplacement and maintenance activities. Depending on the substrate being disturbed, invertebrates could be exposed to contaminants via the water column or resuspended sediments, but effects would depend on the degree of exposure. Assuming projects use installation procedures similar to those proposed in Appendix D, the extent of impacts would be limited to approximately 13 feet (4 meters) to either side of each cable. Therefore, the duration and extent of impacts would be limited and short term, and it would be expected that finfish and invertebrates would recover following this disturbance; however, EFH and other habitats such as eelgrass or hard-bottom habitats, discussed further in Section 3.5.2, may remain permanently altered (Hemery 2020), as eelgrass would be expected to require a greater amount of time to recover. Affected hard-bottom habitat would not be expected to recover, but the extent of hard-bottom habitat that could potentially be affected is assumed to be low relative to the amount of this habitat available throughout the geographic analysis area.

Some types of cable installation equipment use water withdrawals, which can entrain planktonic invertebrate larvae (e.g., squid, crab, lobster) with assumed 100 percent mortality of entrained individuals (MMS 2009). Due to the surface-oriented intake, water withdrawal could entrain pelagic eggs and larvae but would not affect resources on the seafloor. However, the rate of egg and larval survival to adulthood for many species is very low (MMS 2009). Due to the limited volume of water withdrawn, BOEM does not expect population-level impacts on any given species.

Offshore cables associated with wind projects would be similar to those of the Project, including interarray cables, substation interconnection cables, and offshore export cables. The geographic analysis area for finfish and invertebrates is more than 16 million acres (64,750 km^2). The total seafloor disturbance would represent less than 0.1 percent of the geographic analysis area. Cable routes that intersect sensitive EFH such as eelgrass beds or rocky bottom and other more complex habitats may cause long-term or permanent impacts; otherwise, impacts of habitat disturbance and mortality from physical contact with finfish and invertebrates would be recovered in the short term, and overall impacts would be expected to be minor to moderate.

Discharges/intakes: Increases in vessel discharges would occur during construction and installation, O&M, and decommissioning of offshore wind development. Offshore permitted discharges include uncontaminated bilge water and treated liquid wastes. Increases would be greatest during construction and decommissioning of offshore wind projects. Discharge rates would be staggered according to project schedules and localized. Certain discharges are required to comply with permitting standards that are established to minimize potential impacts on the environment.

Other offshore wind projects in the geographic analysis area may use HVDC converter OSPs that would convert AC to DC before transmission to onshore project components. As described in a recent white paper produced by BOEM (Middleton and Barnhart 2022), these HVDC systems are cooled by an open loop system that intakes cool sea water and discharges warmer water back into the ocean. Entrainment and impingement of finfish and invertebrates could occur at HVDC converter intakes on the OSPs. Impacts of entrainment and impingement on finfish and invertebrates at HVDC converter intakes would be limited to the immediate area of the OSPs and to intake volumes.

Additionally, entrainment and impingement would occur at intakes for cable-laying equipment. Impacts on finfish, invertebrates, and EFH from entrainment and impingement at intakes are expected to be localized. Further, as discussed under the *Cable emplacement and maintenance* IPF, entrainment and impingement at cable-laying equipment intakes would be short term. Impacts on finfish, invertebrates, and EFH from discharge volumes and intakes from offshore wind activities are expected to be moderate.

EMF: The marine environment continuously generates a variable ambient EMF. Additional EMFs would also emanate from new offshore export cables and interarray cables constructed for offshore wind projects. Up to 13,373 miles (21,521 kilometers) of cable would be added in the geographic analysis area from other planned offshore wind activities, producing an EMF in the immediate vicinity of each cable during operations. BOEM would require future submarine power cables to have appropriate shielding and burial depth to minimize potential EMF effects from cable operation. EMF effects from these future projects on finfish, invertebrates, and EFH would vary in extent and significance depending on overall cable length, the proportion of buried versus exposed cable segments, and project-specific transmission design (e.g., high-voltage alternating current or high-voltage direct current, transmission voltage). EMF strength diminishes rapidly with distance, and the area around submarine power cables with elevated EMF levels extends less than approximately 33 feet (10 meters) around each cable (CSA Ocean Sciences, Inc. and Exponent 2019). When submarine cables are laid, installers typically maintain a minimum separation distance of at least 330 feet (100 meters) from other known cables to avoid inadvertent damage during installation, which also precludes any additive EMF effects from adjacent cables.

Population-level impacts on finfish have not been documented for EMFs from alternating current cables (CSA Ocean Sciences, Inc. and Exponent 2019). There is no evidence to indicate that EMFs from undersea alternating current power cables adversely affects commercially and recreationally important fish species at a population level in the southern New England area (CSA Ocean Sciences, Inc. and Exponent 2019). A more recent review by Gill and Desender (2020) supports these findings. Other research has been conducted where fish were found to be affected by EMFs at high intensity for a small number of individual finfish species. For example, behavioral impacts have been documented for benthic species such as skates near operating DC cables (Hutchison et al. 2018, 2020b). Skates exhibited changes in behavior in the form of increased exploratory searching and slower movement speeds near the EMF source, but EMFs did not appear to present a barrier to animal movement. A study on larval haddock (Cresci et al. 2022) found that a majority of larvae displayed reduced swimming speed when exposed to magnetic fields in the intensity range of those produced by HVDC cables. Exposure to these magnetic fields could alter the dispersal of Haddock larvae. The magnetic field is localized to the cable and its intensity drops off sharply with distance, meaning that effects on haddock dispersal would be limited to those larvae that come into close contact with the cables.

To date, the effects of EMFs on invertebrate species have not been extensively studied, and studies of the effects of EMFs on marine animals have mostly been limited to commercially important species such as lobster and crab (e.g., Love et al. 2017; Hutchison et al. 2020b). Burrowing infauna may be exposed to stronger EMFs, but scientific data are limited. Recent reviews by Gill and Desender (2020), Albert et al. (2020), and CSA Ocean Sciences, Inc. and Exponent (2019) of the effects of EMFs on marine invertebrates in field and laboratory studies concluded that measurable effects can occur for some species but not at the relatively low EMF intensities representative of marine renewable energy projects. For example, behavioral impacts were documented for lobsters near a direct current cable (Hutchison et al. 2018) and a domestic electrical power cable (Hutchison et al. 2020b), including subtle changes in activity (e.g., broader search areas, subtle effects on positioning, and a tendency to cluster near the EMF source), but only when the lobsters were within the EMF. There was no evidence of the cable acting as a barrier to lobster movement, and no effects were observed for lobster movement speed or distance traveled. Additionally, faunal responses to EMFs by marine invertebrates, including crustaceans and mollusks (Hutchison et al. 2018; Taormina et al. 2018; Normandeau Associates, Inc. et al. 2011), include interfering with navigation that relies on natural magnetic fields, predator/prey interactions, avoidance or attraction behaviors, and physiological and developmental effects (Taormina et al. 2018). A study on bivalves (Jakubowska-Lehrmann et al. 2022) found that exposure to static magnetic fields decreased the filtration rates of a cockle species (*Cerastoderma glaucum*) while EMFs had no effect on filtration. EMF exposure in the cockles was found to lower the ammonia excretion rate and inhibit the activity of the enzyme acetylcholinesterase.

Other studies have found that an EMF does not affect invertebrate behavior. For example, Schultz et al. (2010) and Woodruff et al. (2012) conducted experiments exposing American lobster and Dungeness crab (*Metacarcinus magister*) to EMFs ranging from 3,000 to 10,000 milligauss and found that EMFs did not affect their behavior. Assuming the other wind projects with high-voltage alternating current cables in the geographic analysis area have similar array and export cable voltages as the Proposed Action, the induced magnetic field levels expected for the offshore wind projects are between two and three orders of magnitude lower than those tested by Schultz et al. (2010) and Woodruff et al. (2012). Similarly, a field experiment in Southern California and Puget Sound, Washington, found no evidence that the catchability of two species of crabs was reduced if the animals must traverse an energized alternating current low-frequency (35 kilovolt for one species and 69 kilovolt for the other) submarine power cable to enter a baited trap. Whether the cables were unburied or lightly buried did not influence the crab responses (Love et al. 2017). While these voltages are between two and eight times lower than those proposed for the Project and likely for other projects, the array and export cables would likely be shielded and buried at depth to reduce potential EMFs from cable operation.

A recent study concluded that, similar to invertebrates, impacts on finfish from EMFs are minor or short term, specifically for species that are known to sense EMFs more acutely than pelagic fish species, such as elasmobranchs and benthic species (Bilinski 2021). Based on this study, impacts were limited to minor responses in elasmobranchs and benthic species, which included attraction to cabled areas. It is important to reiterate that EMF impacts on finfish have not been extensively studied, and it remains unknown if finfish experience physiological impacts, what life stages of finfish are most affected by EMFs, and if long-term impacts develop later in life (Bilinski 2021).

EMF levels would be highest at the seabed and in the water column above cable segments that cannot be fully buried and are laid on the bed surface under protective rock or concrete blankets. Wind energy development projects may not be able to bury all cables to sufficient depth and, thus, additional shielding of the cables may be used to dampen EMF effects. Invertebrates in proximity to these areas could experience detectable EMF levels but minimal associated effects. These unburied cable segments would be short and widely dispersed. CSA Ocean Sciences, Inc. and Exponent (2019) found that offshore wind energy development as currently proposed would have negligible effects, if any, on bottom-dwelling finfish and invertebrates residing in the southern New England area. For pelagic species in the same area, no negative effects were expected from offshore wind energy development as currently proposed because of their preference for habitats located at a distance from the seabed.

The information indicates that EMF impacts on finfish, invertebrates, and EFH would be minor, highly localized, and limited to the immediate vicinity of cables and would be undetectable beyond a short distance; however, localized impacts would persist as long as cables are in operation. Most exposure is expected to be of short duration, and the affected area would represent an insignificant portion of the available habitat for finfish and mobile invertebrate species; therefore, impacts on finfish, invertebrates, and EFH would be expected to be minor.

Gear utilization: A range of monitoring activities has been proposed to evaluate the short term and long-term effects of existing and planned offshore wind development on biological resources and are also likely for future wind energy projects on the OCS as part of benthic and fisheries monitoring programs. Monitoring programs are used to establish pre-construction baselines and assess changes or disturbances to benthic and fisheries resources in post-construction periods associated with operations. Some of these monitoring activities are likely to affect finfish, invertebrates, and EFH. For example, the South Fork Wind Fisheries Research and Monitoring Plan (South Fork Wind, LLC and Inspire Environmental 2020) included both direct sampling of finfish and invertebrates and the potential for bycatch of finfish and invertebrates and/or damage to habitat-forming invertebrates and EFH by sample collection gear. Biological monitoring uses the same types of methods and equipment employed in commercial fisheries, meaning that impacts on finfish and invertebrates would be similar in nature but reduced in extent in comparison to impacts from current and likely future regulated fishing activity. Monitoring activities are commonly conducted by commercial fishers under contract who would otherwise be engaged in fishing activity. As such, research and monitoring activities related to offshore wind would not necessarily result in an increase in bycatch-related impacts on finfish and invertebrates, although the distribution of those impacts could change. Therefore, any bycatch-related impacts on finfish and invertebrates would be negligible to minor adverse and short term in duration.

Lighting: Light can attract finfish and invertebrates, including potential prey for finfish, further acting as an attractant for finfish. As such, light could affect finfish movement in highly localized areas. Light can also affect natural reproductive cycles for finfish, such as spawning; however, light would need to be persistent and present for long periods of time to influence natural reproductive cycles (Longcore and Rich 2004). Light is important in guiding the settlement of invertebrate larvae, and artificial light can change the behavior of aquatic invertebrates such as squid, although the direction of response can be species and life stage specific. Offshore wind activities include up to 2,796 offshore WTGs and 51 OSPs in the geographic analysis area. Construction and O&M of these structures would introduce short-term and long-term sources of artificial light to the offshore environment in the form of vessel lighting and navigation and safety lighting on offshore WTGs. Zooplankton diel migration and movement may also be influenced by changes in light exposure. Offshore wind development would result in increased light from offshore structures and vessels. Vessels would be lit during construction, maintenance, and decommissioning. Impacts from vessel lighting would likely be insignificant relative to activities not related to offshore wind activities that occur throughout the geographic analysis area. Furthermore, potential impacts from lighting would be anticipated to have little impact on finfish and invertebrates during daylight hours and would be limited by the depth of the water in the offshore wind lease areas.

The overall impacts of light on finfish, invertebrates, and EFH are likely to be negligible, localized, and short term, resulting in little change to these resources. As such, light from offshore wind development would not be expected to appreciably contribute to overall impacts on these resources, and impacts would be negligible.

Noise: Noise impacts caused by offshore construction, geophysical and geotechnical, and O&M activities; cable laying/trenching; and pile driving could affect finfish and invertebrates. Of these noise-producing factors, noise from pile driving would likely have the greatest impact. Pile-driving noise occurs during installation of foundations for offshore wind structures. Pile driving for construction of more than one offshore wind project may occur concurrently in the geographic analysis area over an 8-year period.

In-water noise is transmitted through the water column and seabed and could cause injury or mortality to finfish present in the vicinity of each pile. Noise from pile driving would cause short-term stress and behavioral changes to finfish and invertebrates. Sound transmission depends on many environmental parameters, such as the sound speeds in the water and substrates. It also depends on the sound production parameters of a pile and how it is driven, including the pile material, size (length, diameter, and thickness), and make and energy of the hammer. Fish response would be highest near impact pile driving (within tens of meters), moderate at intermediate distances (within hundreds of meters), and low far from the pile (within thousands of meters) (COP Appendix U-2; SouthCoast Wind 2024). Behavioral changes induced by sound can be observed in fish up to 7.5 kilometers away from the pile-driving site (Hastings and Popper 2005). During active pile-driving activities, highly mobile finfish likely would be displaced from the area, most likely showing a behavioral response; however, fish in the immediate area of pile-driving activities could suffer injury or mortality. Affected areas would likely be recolonized by finfish in the short term following completion of pile-driving activity. Early life stages of finfish, including eggs and larvae, could experience mortality or developmental issues as a result of noise; however, thresholds of exposure for these life stages are not well studied (Weilgart 2018).

Impacts from pile-driving noise on finfish would also depend on other factors that affect local fish populations, including time of year. Impacts from noise would be greater if occurring during spawning periods or in spawning habitat, particularly for species that are known to aggregate in specific locations to spawn, use sound to communicate, or spawn once in their lifetime. Prolonged localized behavioral impacts on specific finfish populations over the course of years could reduce reproductive success for multiple spawning seasons for those populations, which could result in long-term decline in local populations. Recent studies (de Jong et al. 2020) have found continuous noise exposure to be detrimental to the reproduction of species that use sound to coordinate reproductive behavior. Chronic exposure to continuous noise can induce hearing loss in fish. Anthropogenic noise may also overlap in frequency with the calls made by fish, causing the calls to be drowned out and inaudible to other individuals of the species. Fish-chorusing behavior has been found to change in the presence of noise from pile-driving activities (Siddagangaiah et al. 2021). Calls were found to increase in intensity and change in duration. Deviations in calling behavior may have effects on fish reproductive success, migration, and predation behavior. However, based on behavioral studies of black sea bass (Jones et al. 2020), fish behavior returns to a pre-exposure state following completion of noise impacts. Additionally, as acoustic impacts decline with distance, it is unlikely that impacts of pile driving from wind farms outside of a certain threshold distance would result in any local population being subject to multiple years of acoustic impacts that would result in long-term impacts on the population. Therefore, impacts on finfish from pile driving are anticipated to be temporary and intermittent during periods when pile driving is actively occurring. It is important to note that no planned non-offshore wind pile-driving activities have been identified in the geographic analysis area for this resource other than current ongoing activities.

Marine invertebrates lack internal air spaces and gas-filled organs needed to detect sound pressure and so are considered less likely to experience injury from overexpansion or rupturing of internal organs, the typical cause of lethal noise-related injury in vertebrates (Popper et al. 2001). Noise thresholds for invertebrates have not been developed because of a lack of available data, but some invertebrates are responsive to particle motion and are therefore capable of vibration reception (e.g., crustaceans, squid) (Mooney et al. 2020). This is supported by other studies that found American lobster and shore crabs (*Carcinus maenas*) to have some capability to detect and respond to sound (Jézéquel et al. 2021; Aimon et al. 2021).

The longfin squid (*Loligo pealeii*) has been found to perceive sound similar to fish, but with the use of a statocyst to detect particle motion. This leads to squid being especially sensitive to low frequency sounds (Mooney et al. 2010). Short exposure to low frequency sounds was found to cause traumatic lesions in the statocysts of squid, creating negative impacts on their sense of balance and direction (André et al. 2011). Upon exposure to pile-driving impulses recorded from a wind farm installation, the longfin squid has been found to exhibit an initial startle response, comparable to that of a predation threat, but upon exposure to additional impulses, the squid's startle response diminished quickly, indicating potential habituation to the noise stimulus (Jones et al. 2020). After a 24-hour period, the squid seem to re-sensitize to the noise, which is an expected response to natural stimuli as well. Squid schooling and shoaling behavior could be interrupted when exposed to pile-driving impulse noises, which could affect predation risk. The startle response to pile-driving impulses could disrupt squid spawning behavior should the pile driving occur during spawning season. During feeding, a lower proportion of squid captured live killifish (*Fundulus heteroclitus*) prey in noise exposure trials compared to silent control trials, but these differences in capture rates were not statistically significant. Regardless of whether they were hunting, squids exhibited comparable alarm responses to noise. Hearing measurements confirmed the noise was detected by the squid (Jones et al. 2021).

Noise transmitted through water and through the seabed can cause a disturbance response in invertebrates within a limited area around each pile and short-term stress and behavioral changes in individuals over a greater area (e.g., discontinuation of feeding activity). The extent depends on pile size, hammer energy, and local acoustic conditions, with the affected areas recolonized in the short term. These impacts are therefore anticipated to be temporary and intermittent, occurring only during active impact and vibratory pile driving. A study by Jézéquel et al. (2022) found that bivalve behavior is influenced by the noise generated by pile driving. Scallops across all life stages reacted to pile-driving impact noise by shutting their valves. Scallops did not become acclimated to the noise and continued to react after 2 weeks of repetitive exposure. This response expends energy and leads to increased respiration, leaving the scallops with less energy and more vulnerable to predation. The scallops were found to react to the intermittent, high intensity noise of impact hammer pile driving, but did not react to the continuous, low intensity noise created by vibratory hammer pile driving (Jézéquel et al. 2022).

Noise impacts from geophysical and geotechnical activities are anticipated to occur annually for the foreseeable future but would be localized. Seismic surveys that are used for oil and gas exploration create high-intensity impulsive noise that penetrates the seabed and could cause injury or behavioral impacts on finfish and invertebrates (BOEM 2012). It is important to note that geophysical surveys for the purposes of offshore wind projects are generally used to investigate shallow hazards and hard-bottom areas to evaluate the feasibility of turbine installation; as such, seismic surveys for offshore wind projects do not require use of seismic air guns (used for oil and gas exploration), which penetrate miles into the seabed. Consequently, seismic surveys for offshore wind projects have far fewer impacts than those for oil and gas exploration. Oil and gas exploration on the Atlantic OCS is currently unlikely. High-resolution geophysical (HRG) surveys would be anticipated to occur in the geographic analysis area for the purpose of collecting data on conditions at the seafloor and the shallow subsurface. HRG surveys require use of sparkers and boomers, which generally operate within discrete frequency bands for short durations (relative to seismic air guns). Sparkers and boomers put out less energy relative to seismic air guns and operate in smaller areas and would only be expected to potentially affect finfish and invertebrates close to the activity. During HRG survey activities, finfish and invertebrates close to sparkers and boomers may experience short-term and very localized impacts that could include displacement (BOEM 2021). These impacts would be highly localized around the sound source and would be short term in duration. Finfish and invertebrates in the general area but not in the immediate vicinity of the sound source could experience short-term stress and temporary behavioral changes in a larger area affected by the sound (BOEM 2021; COP Appendix N and U-2; LGL 2024).

Noise from trenching equipment for placement of new or expanded submarine cables and pipelines is likely to occur in the geographic analysis area due to planned and ongoing wind energy projects. It is assumed that while these disturbances are likely to occur, they would be infrequent over the next 35 years. Trenching noise depends on the substrate being trenched, where sandy sediments would be expected to create lower noise levels compared to rocky substrate, larger cobbles, or both. In a study by Subacoustech, noise from trenching was found to be composed of broadband noise, tonal machinery noise, and transients, likely associated with rock breakage; a source level of 178 decibels referenced to a pressure of 1 micropascal (dB re 1 μPa) at 1 meter distance was measured during the study (Nedwell et al. 2003), which is lower than the thresholds where injury to fish would be expected but above the threshold where behavioral changes may occur. Additionally, during cable-laying operations, vessels may use dynamic positioning to stay on course. The noise associated with dynamically positioning vessels has also been shown to illicit a diving response in fish (Peña 2019). As such, noise impacts from trenching would be expected to alter fish behavior at close range. Noise impacts associated with submarine cables and pipelines would be temporary and localized and extend only a short distance beyond the emplacement corridor. Impacts from noise would be lower than impacts from the trenching and disturbance to the seafloor; regardless, the most prominent noise-producing activities would be related to trenching and seafloor excavation, if burial of pipeline or cables is determined to be necessary. Noise from trenching could result in injury or mortality for finfish in the immediate vicinity of the activity and would likely result in temporary behavioral changes in a broader area. These impacts would be short term, and finfish would be expected to return to the areas of impact following any cable or pipeline activities.

Noise from aircraft, vessels, and WTG O&M is expected to occur in the geographic analysis area, but it is anticipated that these activities would have little impact on finfish and invertebrates. Offshore wind projects may require use of aircraft for crew transport during construction and maintenance; however, little noise from aircraft propagates through the water column. Therefore, impacts on finfish from aircraft use are not likely to occur. Future activities related to offshore wind projects presumably would be related to increased vessel traffic associated with both construction and maintenance of WTGs and associated facilities. Vessels associated with construction were found to be loud enough at a distance of up to 10 feet (3 meters) to induce avoidance of finfish and invertebrates but not cause physical harm to the fish (MMS 2009). WTGs are known to produce continuous noise that barely exceeds ambient noise levels at 164 feet (50 meters) from the base of the WTG (Thomsen et al. 2015); this noise would persist for the life of any offshore wind project though would vary with wind speed and operational state.

The overall impacts of noise on finfish, invertebrates, and EFH are likely to be moderate and long term.

Port utilization: It is possible that ports along the eastern seaboard in the geographic analysis area will be upgraded at some time in the future, which would affect offshore habitat. The Northeast Regional Planning Body anticipates that major vessel traffic routes will be relatively stable in the region for the foreseeable future; however, coastal developments and market demands that are unknown at this time could affect them (Northeast Regional Planning Body 2016). The general trend along the East Coast of the United States from Virginia to Maine indicates that port activity will increase modestly in the foreseeable future. These increases in port activity may require port modifications that could cause localized, minor impacts on finfish and EFH, likely resulting in temporary displacement of finfish. Existing ports in the geographic analysis area have already affected finfish, invertebrates, and EFH. It is anticipated that modifications of ports would cause temporary and localized impacts on finfish, invertebrates, and EFH, likely resulting in behavioral responses, such as avoiding the area during port modification activities. These impacts would be limited to the short term and would not be expected to affect finfish and invertebrate species at a population level; however, mortality at less-mobile life stages such as eggs and larvae could occur if individuals were present in the immediate vicinity of port modification activity. The overall impacts of port utilization on finfish, invertebrates, and EFH vary from short term and minor for water quality and vessel noise impacts to permanent and moderate for port expansion activities that heavily modify benthic environments.

Presence of structures: Presence of structures could lead to impacts on finfish, invertebrates, and EFH through entanglement, gear loss or damage, hydrodynamic disturbance, fish aggregation, habitat conversion, and migration disturbances. These impacts could occur through addition of buoys, meteorological towers, WTG foundations, scour/cable protection, and transmission cable infrastructure. Over the next 35 years, development is expected to continue in the geographic analysis area, providing additional structures on the seafloor. Based on assumptions of development for other offshore wind projects, 2,847 foundations would be developed in the geographic analysis area (Appendix D, Table D2-2). BOEM assumes that offshore wind projects would include similar components for construction—that is, WTGs, offshore and onshore cable systems, OSP, onshore O&M facilities, and onshore interconnection facilities—all of which would increase the total number of structures in the geographic analysis area over the next 35 years. In the geographic analysis area, structures are anticipated predominantly on sandy bottom, except for cable protection, which is more likely to be needed where cables pass through hard-bottom habitats. The potential locations of cable protection for planned activities have not been fully determined at this time; however, any addition of scour protection/hard-bottom habitat would represent substantial new hard-bottom habitat, as the geographic analysis area is predominantly composed of sand, mud, and gravel substrates.

The presence of WTG vertical structures such as towers and foundations in the pelagic environment may affect the flow of water within and near offshore wind farms. The general understanding of offshore wind-related impacts on hydrodynamics is derived primarily from European-based studies. A synthesis of European studies by van Berkel et al. (2020) summarized the potential effects of wind turbines on hydrodynamics and fisheries. Local to a wind facility, the range of potential impacts include increased turbulence downstream, remobilization of sediments, reduced flow inside wind farms, downstream changes in stratification, redistribution of water temperature, and changes in nutrient upwelling and primary productivity. Turbulent wakes resulting from the water flow around turbine foundation structures influence local current speed and direction which may increase vertical mixing (Segtnan and Christakos 2015; Grashorn and Stanev 2016; Carpenter et al. 2016; Cazenave et al. 2016), as further described in Section 3.4.2, *Water Quality*, and Section 3.5.6, *Marine Mammals*. During summer, when water is more stratified, increased mixing could increase pelagic primary productivity near the structure, increasing the algal food source for zooplankton and filter feeders. Increased mixing may also result in warmer bottom temperatures, increasing stress on some shellfish and fish at the southern or inshore extent of the range of suitable temperatures. Water column impacts depend heavily on factors such as foundation type and oceanographic conditions (e.g., currents, well-mixed to stratified waters, and depth). While model simulations in European wind farms have shown changes to mixing and stratification downstream of pilings and a potential for cascading ecological effects, discerning the wind facility-induced effect signal from location-specific natural variability in environmental conditions can be challenging (Carpenter et al. 2016; Floeter et al. 2017; Schultze et al. 2020). As environmental conditions in the northeast U.S. shelf differ from European wind farm sites in the North Sea (e.g., seasonal stratification), more research is needed to identify the magnitude and type of impact offshore wind farms will have on ocean processes specific to the U.S. Atlantic OCS (Hogan et al. 2023).

The presence of WTGs is likely to create hydrodynamic effects that could have localized impacts on food web productivity and pelagic eggs and larvae. Addition of vertical structure that spans the water column could alter vertical and horizontal water velocity and circulation. The geographic analysis area is considered seasonally stratified, with warmer waters and high salinity leading to weak stratification in the late summer and early fall. The presence of WTG foundations in the water column can introduce vertical mixing and turbulence that also results in some loss of stratification (Carpenter et al. 2016; Floeter et al. 2017; Schultze et al. 2020). In strongly stratified locations, the mixing seen at foundations is often masked by processes forcing toward stratification (Schultze et al. 2020), but the introduction of nutrients from depth into the surface mixed layer can lead to a local increase in primary production (Floeter et al. 2017). Dorrell et al. (2022) states that offshore wind growth may fundamentally change shelf sea systems, particularly in seasonally stratified seas, but enhanced mixing could positively affect some marine ecosystems. Refer to Section 3.5.6, *Marine Mammals*, for additional discussion regarding hydrodynamic and atmospheric wake effects on secondary impacts to larval transport and primary production.

Wind turbine foundation structures can also influence current speed and direction. Monopile turbulent wakes have been observed and modeled at the kilometer scale (Cazenave et al. 2016; Vanhellemont and Ruddick 2014). While impacts on current speed and direction decrease rapidly around monopiles, there is evidence of hydrodynamic effects out to a kilometer from a monopile (Li et al. 2014). However, other work suggests the influence of a monopile is primarily limited to within 328 to 656 feet (100 to 200 meters) of the pile (Schultze et al. 2020). The discrepancy is likely related to local conditions, wind farm scale, and sensitivity of the analysis. Based on these studies, the turbulent wake effects from monopile foundation structures could occur within 328 to 3,280 feet (100 to 1,000 meters) downstream of each monopile. Hydrodynamic changes at this scale could have localized effects on food web productivity and the transport of pelagic eggs and larvae. Given their planktonic nature, altered circulation patterns could transport pelagic eggs and larvae out of suitable habitat, altering their survivability. Additionally, pelagic juveniles and adults utilizing water column habitats may experience localized hydrodynamic effects down current of each monopile making these pelagic habitats potentially unsuitable. Most juvenile and adult fishes are expected to elicit an avoidance behavioral response away from unsuitable habitat within the turbulent wake of turbine foundation structures.

Net primary productivity is driven by photosynthesis in marine phytoplankton and accounts for half of global-scale photosynthesis and supporting major ocean ecosystem services (Field et al. 1998). There are few empirical data showing the impact of WTGs on ocean stratification (Tagliabue et al. 2021), although recent models have demonstrated ocean mixing as a result of the wind-wake effect of WTGs in the North Sea (Carpenter et al. 2016; Floeter et al. 2017; Dorrell et al. 2022; Christiansen et al. 2022; Daewel et al. 2022). A modeling study of atmospheric wake effects by Daewel et al. (2022) showed that large clusters of offshore wind turbines (5 MW, 295-foot [90-meter] hub height) in the North Sea provoke large scale changes in annual primary productivity. Productivity was modeled to decrease in the center of large wind farm clusters but increased around these clusters in the shallow, near-coastal areas of the inner German Bight and Dogger Bank. These modeled changes in net primary production were found to reach up to 10 percent locally but remained below 1 percent both inside and outside of the offshore wind farm clusters when integrated over a larger scale. As a result of reduced average current velocities, model results also showed a reduction in bottom-shear stress leading to reduced resuspension of organic carbon, increased amounts of organic carbon in sediments, and changes to bottom water oxygen concentrations. While more pronounced locally compared to the region-wide average, changes in sedimentation, seabed processes, and spatial distribution of primary production have the potential to affect higher trophic levels and ecosystem function. The authors indicate the need for more research to assess the combined effects of atmospheric wakes and turbulent wakes induced by wind turbine foundations as the latter might counteract the stabilizing effect of the wind wakes (Daewel et al. 2022). These model results reflect a buildout of turbines that is almost eight times the approximately 3,100 WTGs currently expected to be installed for all wind farms on the East Coast from Massachusetts to North Carolina. While detectable changes to the atmospheric forces that affect sea surface mixing are likely to occur once wind farms on the Atlantic OCS become operational, the potential influence that these impacts will have on biological productivity remains uncertain given the different physical factors in the Project area than were modeled, the much lower number of wind turbines, and the larger size of wind turbines (two to three times larger) planned for the Atlantic OCS compared to those modeled by Daewel et al. (2022).

In a modeling study focused on the buildout of larger-sized WTGs (up to 15 MW and 150-meter hub height) on the U.S. northeast shelf, on average, meteorological changes at the surface induced by next-generation extreme-scale offshore wind turbines (diameter and hub height greater than 492 and 328 feet [150 and 100 meters], respectively) would be nearly imperceptible (Golbazi et al. 2022). The authors simulated the potential changes to near-surface atmospheric properties caused by large offshore wind facilities in the summer and found significant wind speed reduction at hub height within the wind farm (up to 2 meters per second or a 20 percent reduction) that decreased with downwind distance from the wind farm. However, at the surface, an average wind speed deficit of 0.5 meter per second or less (10 percent maximum reduction) was found to occur within the wind farm footprint along with a slight cooling effect (-0.06 Kelvin on average). In comparison, studies on the effects of WTG wind wakes in the North Sea have identified the reduction in wind-induced mixing as the catalyst to changes in upper ocean dynamics (Ludewig 2015; Christiansen et al. 2022) and biological productivity (Daewel et al. 2022). Given the lower wind speed reductions (10 to 20 percent) reported by Golbazi et al. (2022) for the larger wind turbines planned for the U.S. Atlantic OCS compared to a wind speed reduction of up to 43 percent for smaller turbines in the North Sea (Platis et al. 2020), it is plausible that the observed effects from the reduction in wind-induced mixing would also be lessened. However, more region-specific research is still needed to validate this assumption.

Christiansen et al. (2022) modeled the wake-related wind speed deficits that occur due to wind farms in the southern and central North Sea and the resulting larger-scale disturbances on hydrodynamics and thermodynamics. The results of this modeling study predicted surface wind speed reductions potentially extending over tens of kilometers downwind from offshore wind turbine arrays leading to reductions in sea surface currents and potential alterations to temperature and salinity distributions and stratification. Wind wakes and their impacts on hydrodynamic patterns that extend outside the borders of wind farm developments could lead to broadscale effects on nutrient availability, primary production, and ecosystem dynamics (Christiansen et al. 2022; Dorrell et al. 2022; van Berkel et al. 2020). While observations and model scenarios of wind wakes associated with wind energy fields have been generated for wind farms in the North Sea (Schultze et al. 2020; Daewel et al. 2022; Christiansen et al.

2022), there is still uncertainty regarding the applicability of those models to the oceanographic environment of the northeastern U.S. continental shelf (van Berkel et al. 2020; Miles et al. 2021). Oceanographic and hydrodynamic conditions resulting from the presence of offshore structures are not fully understood at this time but may conservatively range from hundreds of meters (Li et al. 2014; Schultze et al. 2020) to tens of kilometers (Dorrell et al. 2022; Christiansen et al. 2022) and are likely to vary seasonally and regionally.

No future activities were specifically identified in the geographic analysis area specific to entanglement, gear loss, and damage; however, it is reasonable to assume that fishing activities (both commercial and recreational) may increase over time in the vicinity of structures due to the likelihood of fish and crustacean aggregation. Damaged and lost fishing gear caught on structures may result in ghost fishing[3] or other disturbances, potentially leading to finfish mortality. Impacts from fishing gear would be localized; however, the risk of occurrence would remain as long as the structures are present. The presence of structures in an otherwise primarily sandy benthic environment would provide a more complex environment, likely to attract finfish and invertebrates such as mobile crustaceans of commercial value. As such, entanglement and gear loss may cause increased impacts on finfish, including mortality and alteration of habitats. These impacts would be localized and short term; however, they would likely persist intermittently as long as structures remain in place.

The addition of new hard surfaces and structures, including WTG foundations, scour protection, and hard protection on top of cables, to a mostly sandy seafloor would create a more complex habitat. Structure-oriented finfish species such as black sea bass, striped bass, and Atlantic cod (among others) would be attracted to these more complex structures (Wilber et al. 2022; Hutchison et al. 2020a; Methratta and Dardick 2019). In a meta-analysis of studies on windfarm reef effects, Methratta and Dardick (2019) noted an almost universal increase in the abundance of epibenthic and demersal fish species. At the Block Island Wind Farm, Hutchison et al. (2020a) and Wilber et al. (2022) documented a high abundance of black sea bass, Atlantic cod, scup, bluefish, monkfish, winter flounder, striped bass, tautog, and dogfish around the offshore wind farm structures as a result of the added habitat and foraging opportunities created by the artificial reef effect. Colonization of these new hard structures by more sessile and benthic organisms (e.g., sponges, algae, mussels, shellfish, sea anemones) would also likely occur over time (Degraer et al. 2020; Kerckhof et al. 2019; De Mesel et al. 2015). Higher densities of filter feeders, such as mussels that colonize the structure surfaces, could consume much of the increased primary productivity but also provide a food source and habitat to crustaceans such as crabs (Dannheim et al. 2020). Mussels have been found to be the preferred food source of Jonah crabs in the Gulf of Maine by Donahue et al. (2009). These impacts would likely be permanent or remain as long as the structure remains. It is important to note that increases in biomass to any specific region due to the presence of hard substrates (WTGs in this case) is not necessarily an ecosystem benefit; rather, the long-term impacts of the artificial reef effect would be characterized as unknown. Moreover, increased fish

[3] *Ghost fishing* refers to entrapment, entanglement, or mortality of marine life in discarded, lost, or abandoned fishing gear, which can also smother habitat and act as a hazard to navigation.

aggregation could result in increased regulated fishing, potentially leading to higher biomass removal if the artificial reef effect results in greater fish aggregation without a related increase in fish production.

In contrast to the potential beneficial effects of WTG foundations creating an artificial reef effect, these structures could also facilitate introduction and spread of non-native species through the stepping-stone effect. New hard substrate structures in the environment could provide opportunity for non-native species to colonize in an area that would otherwise be unable to settle due to lack of hard substrate habitat/structures. If established, new networks of hard substrate structures (WTG foundations in this case) could serve as new environments on which non-native species could propagate and expand. Studies of WTGs in the North Sea of Scotland found that non-native species were thriving on offshore structures, confirming that the stepping-stone effect can occur in offshore environments if non-native species are present, introduced, or both (De Mesel et al. 2015). Expansion of non-native species in offshore environments can cause ecological impacts on an area if allowed to propagate and expand.

Finfish aggregation around structures could be perceived as beneficial, adverse, or neutral for finfish and invertebrates. Aggregation and colonization would likely lead to increased fishing pressure at structures and may result in adverse predation pressures; however, complex structures generally provide protection and potential habitat for egg laying and larvae recruitment, which would be considered beneficial to finfish species and some invertebrate species. On the other hand, species that rely on soft-bottom habitat, such as surfclams and longfin squid, would experience a reduction in favorable conditions but not to the extent that population-level impacts would be expected (Guida et al. 2017). The addition of structures in the geographic analysis area would not be expected to impede migratory fish or invertebrate movement through these areas.

In this context, BOEM anticipates that the impacts associated with the presence of structures may be negligible to moderate and long term. The impacts on finfish, invertebrates, and EFH resulting from the presence of structures would persist for the duration for which the structures remain.

Traffic (vessel strikes): The presence of vessels introduces the risk of vessel collision with marine life, and vessel collisions with marine life are an ongoing threat in the geographic analysis area due to vessels from numerous industries such as trade, tourism, resource development, and offshore wind development. Marine species that spend a significant time near the water surface or in areas where vessel routes overlap with migration, feeding, or breeding grounds have the potential to be struck by vessels (SEER 2022). Vessel collisions may result in blunt-force and sharp-force trauma, both of which can result in death, but are likely to be underrepresented due to a lack of reporting awareness and because not all struck marine animals are recoverable for documentation. Impacts of vessel collisions can result in injury and mortality and may affect populations of some ESA-listed species. Vessel speed reductions and route restrictions have shown to be effective mitigation measures for reducing the impacts related to vessel collisions. Additionally, BOEM expects minimization measures for vessel impacts would be required for planned offshore wind activities, further reducing the risk of injury or mortality for finfish and mobile invertebrates, resulting in negligible impacts.

Impacts of Alternative A – No Action on ESA-Listed Species

Several ESA-listed species may occur in the geographic analysis area, including Atlantic sturgeon (*Acipenser oxyrinchus*), shortnose sturgeon (*Acipenser brevirostrum*), giant manta ray (*Manta briostris*), Gulf of Maine distinct population segment of Atlantic salmon (*Salmo salar*), and oceanic whitetip shark (*Carcharhinus longimanus*). Ongoing and planned activities, including offshore wind activities, would continue to affect these ESA-listed species through both temporary and permanent impacts. Due to the mobile nature and preferred habitats of these species, the presence of structures, light, and offshore cable emplacement and maintenance IPFs are expected to have negligible impacts. Nearshore cable emplacement, maintenance, and resulting EMFs may affect shortnose and Atlantic sturgeon, but these impacts are expected to be minor. The primary impacts expected to affect ESA-listed finfish include noise (specifically, pile-driving activities), regulated fishing efforts, and climate change. Of these, regulated fishing and climate change would likely have long-term minor to moderate impacts from bycatch and similar climate change effects on ESA-listed finfish as on other finfish. Noise from pile driving has the potential to injure or kill sturgeon, but the scale of duration and the area of effects would likely lead to minor impacts with appropriate mitigation. Other ongoing and planned activities such as increased vessel traffic, new subsea cables and pipelines, onshore construction (including ports), channel maintenance, and installation of permanent non-offshore wind-related structures would be expected to have negligible to minor effects. Shortnose and Atlantic sturgeon are prone to vessel strikes in nearshore environments, while giant manta rays are at risk of vessel strikes occurring offshore. However, the dispersed nature of vessel traffic makes these events unlikely. Accidental releases are likely to have minor impacts on sturgeons in most locations. Combining all offshore wind and ongoing and planned non-offshore wind activities (including all of the IPFs discussed) in the geographic analysis area would result in long-term minor to moderate impacts on ESA-listed finfish and invertebrates. Any future federal or private activities that could affect federally listed fish in the geographic analysis area would need to comply with ESA Section 7 or Section 10, respectively, to ensure that the proposed activities would not jeopardize the continued existence of the species.

Conclusions

Impacts of the No Action Alternative: Under the No Action Alternative, finfish and invertebrates would continue to be affected by existing environmental trends and ongoing activities throughout the geographic analysis area. BOEM expects ongoing activities to have continuing short-term, long-term, and permanent impacts (e.g., disturbance, injury, mortality, habitat degradation, habitat conversion) on finfish, invertebrates, and EFH primarily through regular maritime activity, ongoing offshore wind activity, and climate change. The No Action Alternative would likely have **moderate adverse** impacts on finfish and invertebrates.

Cumulative Impacts of the No Action Alternative: Under the No Action Alternative, existing environmental trends and ongoing activities would continue, and finfish, invertebrates, and EFH would continue to be affected by natural and human-caused IPFs. Planned non-offshore wind activities would contribute to the impacts on finfish, invertebrates, and EFH through increased vessel traffic, new subsea cables and pipelines, onshore construction (including ports), channel maintenance, and installation of permanent non-offshore wind-related structures.

Offshore wind activities are anticipated to affect finfish, invertebrates, and EFH through primary IPFs that include cable emplacement and maintenance, noise (specifically pile-driving activities), and presence of structures. Considering all the IPFs together, BOEM anticipates that the No Action Alternative, when combined with planned activities in the geographic analysis area, would result in **moderate adverse** impacts on finfish, invertebrates, and EFH. However, regardless of offshore wind-related activities in the geographic analysis area, it is anticipated that the greatest impact on finfish and invertebrates would be caused by ongoing regulated fishing activity and climate change.

3.5.5.4 Relevant Design Parameters and Potential Variances in Impacts

This EIS analyzes the maximum-case scenario; any potential variances in the proposed Project build-out as defined in the Project Design Envelope would result in impacts similar to or less than those described in the following sections. The following Project Design Envelope parameters (Appendix C, *Project Design Envelope and Maximum-Case Scenario*) would influence the magnitude of the impacts on finfish, invertebrates, and EFH.

- The number, size, and locations of WTGs and OSPs.
- Total length of export and interarray cables.
- The time of year during which construction occurs.

Variability of the proposed Project design exists as outlined in Appendix C. A summary of potential variances in impacts follows.

- WTG number and locations: The level of hazard related to WTGs is proportional to the number of WTGs installed, with fewer WTGs requiring fewer foundations resulting in fewer construction-related impacts on finfish, invertebrates, and EFH.
- Season of construction: Finfish vary in their migration movements, meaning that certain species may be present at different times of year, and their chosen depth in the water column may also be influenced by time of year and water temperature. Some mobile invertebrates also vary in their migration movements, and sensitive life stages are present at certain times of the year. Any construction window would affect finfish species; however, certain windows may avoid larger migratory movements and potential impacts on sensitive fish species, such as Atlantic sturgeon, that may occur in the Project area and are listed under the ESA.

SouthCoast Wind has committed to measures to minimize impacts on finfish, invertebrates, and EFH by conducting and evaluating geotechnical and geophysical surveys to identify and avoid sensitive habitats if possible, as well as vessel speed restrictions, sound-attenuation measures, soft starts during pile driving, varied species monitoring and reporting, and several BOEM best management practices (COP Volume 2, Table 16-1; SouthCoast Wind 2024).

3.5.5.5 Impacts of Alternative B – Proposed Action on Finfish, Invertebrates, and Essential Fish Habitat

The following sections summarize potential impacts of the Proposed Action on finfish, invertebrates, and EFH during construction and installation, O&M, and conceptual decommissioning of the Project, as described in Chapter 2, *Alternatives*.

Accidental releases: As discussed in Section 3.5.5.3, *Impacts of Alternative A – No Action on Finfish, Invertebrates, and Essential Fish Habitat*, nonroutine events, such as accidental oil or chemical spills, can have adverse or lethal effects on marine life; however, applicant-proposed measures, such as a spill prevention and a response plan, would be developed and implemented during all phases of the Proposed Action. The risk of any type of accidental release would be increased, primarily during construction, but also during O&M and decommissioning of offshore wind facilities (COP Appendix AA, Section 8.3.1, Table 8-3; SouthCoast Wind 2024 discusses the maximum-case scenarios of potential releases). Modeling by Bejarano et al. (2013) predicted that the impact of smaller spills on benthic invertebrates would be low, and any accidental releases from the Project are expected to be localized. Larger spills are unlikely but could have a larger impact on benthic fauna due to adverse effects on water quality (Section 3.4.2, *Water Quality*). Compliance with USCG regulations would minimize the risk of accidental release of trash or debris. Another potential impact related to vessels and vessel traffic is the accidental release of invasive species, especially during ballast water and bilge water discharges from marine vessels. 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 National Pollutant Discharge Elimination System Vessel General Permit standards, both of which aim at least in part to prevent the release and movement of invasive species. Adherence to these regulations would reduce the likelihood of discharge of ballast or bilge water contaminated with invasive species. The risk of accidental releases would be increased by the additional vessel traffic associated with the Proposed Action, especially traffic from foreign ports, primarily during construction. The potential impacts on benthic resources are described in Section 3.5.2. As described for construction and installation, the Proposed Action would comply with all laws regulating at-sea discharges of vessel-generated waste, and Project measures to avoid or limit accidental release would be adopted. Impacts due to accidental releases on finfish, invertebrates, and EFH would be negligible.

Anchoring: Vessel anchoring, including use of spud cans on jack-up vessels, would cause short-term impacts on finfish and invertebrates in the immediate area where anchors, spud cans, and chains meet the seafloor in offshore sandy environments. Impacts would include turbidity affecting finfish and invertebrates and injury, mortality, and habitat degradation, primarily of invertebrates. All impacts would be localized, turbidity would be temporary, and displacement and mortality from physical contact would be recovered in the short term. Impacts may be higher in sensitive habitats (e.g., eelgrass beds, hard-bottom habitats) and other EFH. Degradation of EFH and other sensitive habitats such as SAV or hard-bottom habitats, if it occurs, could be long term to permanent. BOEM could require SouthCoast Wind, as a condition of COP approval, to develop and implement an anchoring plan, potentially in combination with additional habitat characterization. Such a plan could reduce the area of sensitive habitats affected by anchoring, but avoidance of all sensitive habitats is not likely feasible. The overall impacts of anchoring on finfish, invertebrates, and EFH are likely to be minor adverse, localized, and short term.

Cable emplacement and maintenance: The Proposed Action would entail a maximum of approximately 1,676 miles (2,697 kilometers) of new cable installation, which includes 497 miles (800 kilometers) of interarray cables and 1,179 miles (1,897 kilometers) of offshore export cables. The primary impacts on finfish, invertebrates, and EFH associated with cable emplacement include habitat alteration, sediment resuspension, and entrainment during seabed preparation activities and cable installation. An estimated cable emplacement seabed disturbance area of 1,408 acres (570 hectares) is anticipated for the interarray cables, 1,753 acres (709 hectares) for the Falmouth export cable, and 727 acres (294 hectares) for the Brayton Point export cable (COP Volume 1, Tables 3-29 and 3-30; SouthCoast Wind 2024). Seabed preparation activities may be conducted in some areas prior to cable installation and may include cable installation surveys, boulder removal, grapnel runs, sand wave dredging, UXO clearance, and seabed leveling. Export and array cables would be installed via jet trenching, precut plow, mechanical plow, and mechanical cutting, as necessary. Cable micro-routing based on geophysical surveys is expected to minimize impacts on complex habitats and maximize the likelihood of sufficient cable burial.

Boulder clearance or relocation would be minimized through micro-routing of cables within each ECC. Any boulders discovered in the pre-installation surveys that cannot be easily avoided by micro-routing could be removed with a grab lift or plow, as needed (COP Volume 1; SouthCoast Wind 2024). Specific locations to which boulders would be relocated are still to be determined. However, it is planned that any relocated boulders would be placed within the ECC in seabed areas similar to those from which they were removed. The surface disturbance area per cable due to boulder clearance or relocation is estimated to be 34 acres in the Brayton Point ECC and 43 acres in the Falmouth ECC. Boulder field clearance in the Falmouth ECC is expected to be needed primarily in areas traversing Muskeget Channel and Nantucket Sound (Figure 3.5.5-2). A boulder relocation plan is currently in development, but anticipated boulder clearance areas have been outlined (COP Appendix M.3; SouthCoast Wind 2024). These areas are defined as 49 feet (15 meters) in width for each cable installation. In areas where the use of a boulder clearance plow is necessary, the plow is pulled along the seabed and scrapes the seabed surface pushing boulders out of the cable corridor, flattening sand ripples in the process. In low-density boulder fields, an orange peel grabber may be utilized for boulder relocation minimizing impacts to sensitive and slow to recover habitats used by hard-bottom associated EFH species. The boulder grab would be used to the extent possible, and the use of the 49-foot (15-meter)-wide boulder plow would be minimized. If the use of boulder plow is necessary, the plow may be ballasted to only clear boulders and avoid the creation of a deep depression in the seabed.

Dredging is most likely in sand wave areas where typical jet plowing is insufficient to meet target cable burial depth. Sand wave clearance areas in the Falmouth ECC are expected to potentially occur within a 0.9-mile (1.4-kilometer) and 2.1-mile (3.4-kilometer) section north of Martha's Vineyard, and a 2.1-mile (3.3-kilometer) section within the Muskeget Channel (Figure 3.5.5-2). No sand wave clearance is expected in the Brayton Point ECC. The total estimated seabed disturbance resulting from vessel anchoring during cable emplacement activities in identified ECC anchoring areas (Figure 3.5.5-2) is 8.9 acres (3.6 hectares) for the Falmouth ECC and 2.8 acres (1.1 hectares) for the Brayton Point ECC (COP Volume 1; SouthCoast Wind 2024).

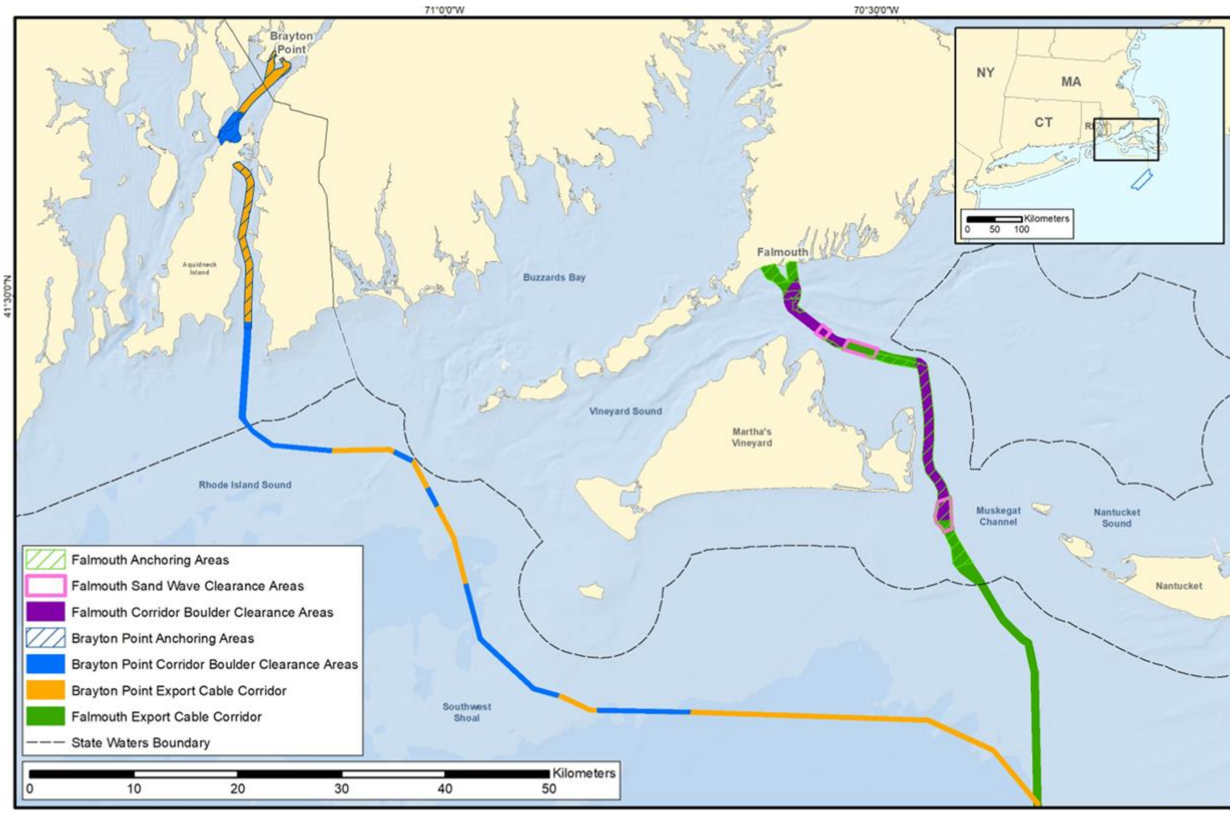


Figure 3.5.5-2. Temporary seabed disturbance locations in the Falmouth and Brayton Point ECCs from seabed preparation activities which include vessel anchoring, boulder clearance, and sand wave clearance

SouthCoast Wind has estimated that seabed preparation prior to cable installation would result in short-term disturbances to benthic habitats that occur over an estimated area of up to 99 acres for interarray cables in the Lease Area and up to 203 acres in the ECCs. Seabed preparation in this area is expected to disturb both soft-bottom and complex benthic habitat. Additionally, boulder relocation would potentially alter the composition of both the original and relocated habitats for boulder fields present along the Falmouth ECC including portions of the Muskeget Channel and in the Brayton Point ECC, which includes sections of the Sakonnet River and Mount Hope Bay. Medium- and low-density boulder fields in large-grained complex habitats are important EFH for several managed species, including Atlantic cod (adults and spawning adults), longfin squid (i.e., benthic squid mops), ocean pout (all life stages), winter flounder (adults), and monkfish (adults and juveniles). Damage caused to medium- and low-density boulder fields, as well as associated biogenic features and attached, habitat forming organisms that provide shelter, attachment surfaces, and prey resources for the aforementioned EFH species would incur direct impacts. Over time, the relocated boulders would be recolonized, contributing to the habitat function provided by existing complex benthic habitat of relocated boulders.

Sand waves and biogenic depressions are a component of juvenile and adult EFH used by red and silver hake. Seabed preparation (i.e., sand wave clearance by dredging) and cable installation would flatten depressions and ripples and mega-ripples, and damage structure provided by habitat forming organisms, such as amphipod tubes. Amphipods are important prey for several soft-bottom EFH species and life stages including red hake (juveniles), winter flounder (young-of-year, juveniles, and adults), and winter skates (juveniles and adults), and impacts on these biogenic features could result in limited prey availability for these species and refuge from predators. These combined effects would reduce habitat suitability within the cable installation footprint for EFH species that associate with soft-bottom habitat. Sand waves are naturally dynamic features in soft-bottom benthic habitats. As such, these habitat features are expected to recover rapidly from seabed preparation impacts, within 18 to 24 months following initial disturbance through natural sediment transport processes and recolonization by habitat-forming organisms from adjacent habitats. This conclusion is supported by knowledge of regional sediment transport patterns (Dalyander et al. 2013), observed recovery rates from seabed disturbance at the nearby Block Island Windfarm (HDR 2020), and recovery rates from similar bed disturbance impacts observed in other regions (de Marignac et al. 2009; Dernie et al. 2003; Desprez 2000).

Project-specific sediment dispersion modeling was completed using proposed cable installation methods, site-specific sediment grain size and bathymetric data, and a high-resolution wave and current model for each export cable corridor and interarray cables. Results showed that redeposition of suspended sediments occurs quickly before being transported long distances. Total suspended solid concentrations above 100 milligrams per liter (mg/L) (0.0008 pounds per gallon) extended a maximum of 1,214 feet (370 meters) for any scenario except for nearshore areas of the Brayton Point corridor, where they extended to just over 1 kilometer (0.62 mile). The maximum total suspended solid level dropped below 10 mg/L (0.00008 pounds per gallon) within 2 hours for all simulated scenarios and dropped below 1 mg/L (0.000008 pounds per gallon) within 4 hours for any scenario except for nearshore areas of the Brayton Point corridor, where 100 mg/L and 10 mg/L concentrations lasted for less than 5 hours and a little over 2 days, respectively. Deposition thicknesses exceeding 0.20 inches (5 millimeters) were generally limited to a corridor with a maximum width of 79 feet (24 meters) around the cable routes but reached a maximum of 590 feet (180 meters) from the centerline for the interarray cables (COP Appendices F1 and F3; SouthCoast Wind 2024).

Even though invertebrates have a range of susceptibility to suspended sediments and sediment deposition based on life stage, mobility, and feeding mechanisms, invertebrates in this area would be expected to recover in the short term. Sediment plumes in the water column would likely cause temporary displacement of finfish and mobile invertebrates, but they would be expected to return following settlement of sediments. Nearshore/inshore environments, such as bays where cable installation would occur, would likely cause temporary displacement of finfish and mobile invertebrates due to sediment resuspension in the water column. In general, nearshore environments have finer sediments that take longer to settle back to the seafloor, thus potentially causing impacts on EFH.

Some types of seabed preparation equipment such as hydraulic dredgers (e.g., trailing suction hopper dredgers) use water withdrawals, which can entrain planktonic larvae of benthic fauna (e.g., larval polychaetes, mollusks, crustaceans) and fish. Hydraulic dredging methods pose a high risk of entrainment to benthic or epibenthic eggs, larvae, and juvenile fish through the direct uptake of organisms by the suction field generated at the draghead during dredging operations (Reine and Clarke 1998). While potential for entrainment may be high, overall mortality rates of entrained fish may be lower depending on the scale of the dredging operation and type of hydraulic dredger (Wenger et al. 2017). Because of the limited volume of water withdrawn, BOEM does not expect population-level impacts on any given species. This is because the rate of egg and larval survival to adulthood for many species is naturally very low (MMS 2009). The impacts associated with increased turbidity caused by this IPF are discussed in Section 3.5.5.3.

Installation of the interarray cable and ECCs could result in direct impacts such as crushing and burial of slow-moving or sessile organisms and life stages. Direct mortality of benthic life stages and sessile organisms could also result from fluidizing the sediments along the cable corridors during cable burial. The effects of crushing and burial impacts on EFH resulting from cable installation would vary depending on how benthic and demersal habitats exposed to these impacts are used by EFH-designated species. Benthic and epibenthic life stages would be the primary groups affected, with secondary effects on EFH-designated species and life stages that prey on benthic and epibenthic organisms. Mobile organisms such as juvenile and adult finfish may be temporarily displaced by cable installation but will be able to avoid direct impacts related to these activities. It is anticipated that pelagic species and motile life stages will avoid construction activities based on typical installation speeds, and direct impacts are not anticipated. Direct impacts on foraging habitat are expected to be localized to the width of the trench and short term as benthic organisms would recolonize the area. Indirect impacts on EFH could occur as a result of sediment suspension, temporarily decreasing foraging success due to increased turbidity. It would be expected that normal foraging behavior would resume following completion of installation and settlement of suspended sediments.

In addition to crushing and burial impacts, installation methodologies could reshape benthic structures and habitats depending on the cable installation method used. Jet-plowing, which would flatten depressions and sand waves could temporarily reduce benthic habitat suitability for juvenile and adult red and silver hake within the cable plow footprint. In contrast, mechanical trenching may create short-term depressions that would serve the same habitat function and potentially leave little impact on juvenile and adult red and silver hake. However, it is difficult to quantify features like sand depressions and sand waves because these habitats are dynamic and shaped by sediment transport processes. Natural recovery from anthropogenic disturbance is likely to occur within several months of the disturbance.

During construction, seabed disturbance resulting from the Proposed Action would lead to impacts on finfish, invertebrates, and EFH, which include injury, mortality, and habitat alteration. The areas affected by seabed preparation and cable installation would be rendered temporarily unsuitable for species associated with complex, heterogenous complex, and soft-bottom benthic habitats during one or more life stages. Array cable and export cable emplacement would, therefore, result in short-term adverse effects on finfish, invertebrates, and EFH lasting through seabed preparation activities and cable installation but would be expected to recover shortly after installation. BOEM expects the impacts due to cable emplacement on finfish, invertebrates, and EFH to be moderate while cable maintenance activities would have minor impacts.

SouthCoast Wind is considering benthic imagery surveys to monitor benthic habitats and invertebrate impacts and recovery during the construction, O&M, and decommissioning phases (COP Volume 2, Table 11-20; SouthCoast Wind 2024). Such surveys would aid in evaluating the impacts from cable installation and maintenance.

Discharges/intakes: Increases in Project vessel discharges would occur during construction and installation, O&M, and decommissioning. As described under the No Action Alternative, certain discharges are required to comply with permitting standards that are established to minimize potential impacts on the environment. Impacts from entrainment and impingement of finfish and invertebrates associated with cable emplacement would be mostly confined to cable centerlines and would be short term and minor.

Entrainment and impingement of finfish and invertebrates could occur at the HVDC converter OSP intake of Project 1 and potentially for Project 2 should SouthCoast Wind also select an HVDC converter OSP design. If HVAC OSPs are used, entrainment and impingement impacts would not occur. SouthCoast Wind developed a NPDES permit application for one offshore HVDC converter OSP in the Lease Area for Project 1 (Appendix B, Figure B-2) (TetraTech and Normandeau Associates, Inc. 2023). If SouthCoast Wind selects HVDC technology for Project 2, the parameters and modeling results from the NPDES permit application for Project 1, described below, would be representative of a HVDC converter OSP for Project 2 located in the southern portion of the Lease Area.

The cooling water intake system (CWIS) located within the jacketed foundation structure associated with the HVDC converter OSP is expected to withdraw seawater from the ocean at a rate of approximately 9.9 million gallons per day at a depth of 74 feet (22.6 meters) below the surface and 81 feet (24.7 meters) above the seafloor (TetraTech and Normandeau Associates, Inc. 2023). This mid-water column depth of withdrawal minimizes entrainment impacts as it avoids the higher concentrations of buoyant ichthyoplankton that inhabit surface waters (Sundby and Kristiansen 2015) and those planktonic taxa associated with benthic habitats (Kendall and Naplin 1981). The CWIS is also designed to maintain an intake velocity of 0.5 feet (0.2 meter) per second or less to minimize impingement impacts.[4]

Impacts of entrainment on finfish and invertebrates at HVDC converter intakes are anticipated to be limited to the immediate area of the OSP(s). To minimize potential impacts on zooplankton from entrainment, SouthCoast Wind has committed to siting the northernmost HVDC converter OSP outside of a 10-kilometer buffer of the 30-meter isobath from Nantucket Shoals, an area of high productivity and foraging value for several marine species (COP Volume 2, Table 16-1; SouthCoast Wind 2024). Given the limitations of recent data immediately in the vicinity of the intake location, SouthCoast Wind's NPDES permit application used EcoMon plankton data from 1977 from 2019 to estimate entrainment

[4] USEPA considers intake velocities of 0.5 feet per second or less a suitable compliance option to minimize impingement impacts.

abundance from cooling water withdrawal at the OSP (TetraTech and Normandeau Associates, Inc. 2023). The minimum, mean, and maximum larval densities observed within 10 miles (16 kilometers) of the OSP location were used to extrapolate the range of entrainment abundance. The annual entrainment abundance of fish larvae was estimated to range from 8.3 million to 174.4 million with a mean estimate of 83.2 million. Based on monthly mean larval densities and excluding unidentified fish, the taxa with the highest estimated larval entrainment annually were hakes (3.9 million), Atlantic herring (3.9 million), sand lances (3.3 million), summer flounder (1.3 million) and silver hake (0.5 million) (TetraTech and Normandeau Associates, Inc. 2023).[5] Impacts from entrainment of finfish and invertebrates associated with HVDC converter OSPs would be continuous during the O&M phase resulting in long-term and moderate impacts.

In addition to entrainment impacts, the HVDC converter OSP would discharge warmer water into the surrounding ocean, which could have localized impacts on fish species. Discharge would occur at one 36-inch (0.91-meter) diameter vertical-shaft discharge caisson, located in the middle portion of the water column at a depth of 42.7 feet (13 meters) below the surface, set perpendicular to the seafloor, and within the jacketed foundation structure (TetraTech and Normandeau Associates, Inc. 2023). The impact of raised water temperatures on living organisms is most frequently seen in the lowered dissolved oxygen saturation level of warmer water since dissolved oxygen levels are often a limiting factor for organism survival (Mel'nichenko et al. 2008). Further, temperature affects the speed of egg development and growth of offspring (Walkuska and Wilczek 2009). SouthCoast Wind modeled thermal plumes of the discharged cooling seawater from the HVDC converter OSP. From four modeled maximum temperature delta scenarios in the fall, winter, spring, and summer (TetraTech and Normandeau Associates, Inc. 2023), the distance from the discharge point where the temperature delta reached 1°C (1.8°F) was 41.9 feet (12.8 meters) in the fall, 84.9 feet (25.9 meters) in the winter, 67.5 feet (20.6 meters) in the spring, and 46.6 feet (14.2 meters) in the summer. The effluent plume area was highest in the winter at 792.1 square feet (73.6 square meters) and lowest in the fall at 407.0 square feet (37.8 square meters). These results indicate that impacts on the ocean temperature are localized and minimal when the maximum temperature increases occur and that the water quality standard allowed for by the Ocean Discharge Criteria is expected to be met well within the 100-meter (330-foot) radius mixing zone for initial dilution of discharges (TetraTech and Normandeau Associates, Inc. 2023). The limited range of warmed water, local oceanographic conditions, and the ability of fish to move out of the affected area would likely result in long-term and minor impacts on fish species. Similar results would be anticipated if SouthCoast Wind selects a second HVDC converter OSP for the southern portion of the Lease Area.

---

[5] As further described in the NPDES application (TetraTech and Normandeau Associates, Inc. 2023), due to limitations in the available data, there are uncertainties in these results. For example, entrainment estimates do not fully capture the annual entrainment abundance of all fish and life stages, as all fish eggs and the larvae of less common taxa are excluded from the publicly available EcoMon data set. Additionally, the estimates assume the 1977–2019 time series is representative of the current and future species composition, and that abundance will remain constant each year. The data also represents sampling of ichthyoplankton at various depths, whereas the OSP intake would withdraw water from a discrete depth in the water column (81 feet [24.7 meters] above the seafloor). This may result in overestimation of larval entrainment, as individuals settling in demersal habitats or floating on the surface may not be susceptible to the intake flow.

During installation of up to 85 suction-bucket jacket WTG foundations in the southern portion of the Lease Area as part of Project 2, planktonic organisms may become entrained as water is pumped out of the buckets during the embedding process. An entrainment assessment was conducted to estimate the potential impact this construction activity may have on zooplankton and ichthyoplankton species present within the installation area (RPS 2024). The presence and abundance of plankton species in the SouthCoast Wind suction-bucket jacket installation area was determined using NOAA-NEFSC Ecosystem Monitoring (EcoMon) survey program plankton data (NEFSC 2019) limited to within 3.10 miles (5 kilometers) of the foundation installation area. This analysis area was used on the assumption that foundation installation is a one-time localized action with short-term entrainment impacts. Monthly entrainment estimates for suction-bucket foundation installations were calculated using a per foundation one-time total seawater displacement volume of 27,200 cubic meters (6,800 cubic meters per bucket by four buckets per foundation), the assumption that the installation of 85 suction-bucket jacket foundations would occur evenly over a 16-month period from April 2030 to July 2031, and the taxa-specific EcoMon plankton density data averaged by month.

Excluding unidentified fish (Pisces), the ichthyoplankton taxa with the highest estimated monthly larval entrainment were the Atlantic mackerel (944,475; June), sand lance (394,397; January), hake (259,068; August), and gulf stream flounder (248,608; September). Summer flounder and Atlantic cod were estimated to have relatively low monthly larval entrainment in the suction-bucket jacket installation area with a peak of 16,614 (October) and 3,920 (February) individuals, respectively. Total estimated entrainment (number of individuals) by taxa from start to completion of suction-bucket jacket foundation installation was highest for Atlantic mackerel (954,383) followed by sand lance (869,447), gulf stream flounder (507,854), and hake (488,465) (RPS 2024). While entrainment estimates were generated from the best available data, these estimates do not reflect the current species composition in the study area, seasonality, population dynamics, and natural variability due to the limitations of the data set used and given that no project-specific studies have been conducted to characterize the local composition of plankton species in the vicinity of the suction bucket installation area and the susceptibility of these species to the impacts of entrainment. As the installation of suction-bucket jacket foundations is a one-time localized action, entrainment impacts are considered short term and limited to the immediate vicinity of the installation activity.

Many fish species in the region exhibit broadcast spawning or other high fecundity reproductive strategies that produce thousands to millions of eggs per fish (e.g., Kelly and Stevenson 1985; Kjesbu 1989; Morse 1980; Papaconstantinou and Vassilopoulou 1986; Pitt 1971). Given these high fecundity rates, entrainment mortality at the scale estimated here is not expected to result in population-level effects on EFH species. It is important to note that the entrainment analysis excluded fish eggs, such that the estimates presented are less than the potential entrainment of all life stages. However, given the high natural mortality of the egg stage for most fish species and the relatively small volume of water being withdrawn, entrainment mortality of eggs is expected to be small relative to natural egg mortality. Entrainment mortality would also remove some small organisms that are consumed by planktivorous species, potentially resulting in a loss in foraging opportunity for sessile EFH species such as filter-feeding invertebrates. However, mobile and pelagic species are not expected to experience losses in foraging opportunities because they can move to feed in areas outside the suction bucket foundation footprint. Therefore, the entrainment impact from the installation of 85 suction-bucket jacket foundations in the southern portion of the Lease Area would constitute a short-term negligible effect on finfish, invertebrates, and EFH.

Gear utilization: SouthCoast Wind has proposed a variety of survey methods to evaluate the effect of construction and operations on benthic habitat structure and composition and economically valuable fish and invertebrate species. Fisheries and benthic monitoring plans to be conducted within the Lease Area and the Brayton Point ECC during the pre-construction, construction, operations, and decommissioning phases of the Project have been developed in coordination with the University of Massachusetts Dartmouth's School for Marine Science and Technology (SMAST), the Anderson Cabot Center of Ocean Life at the New England Aquarium, and federal and state agencies, and align with BOEM guidelines (BOEM 2019) with additional recommendations provided by the Responsible Offshore Science Alliance Fisheries Monitoring Working Group.

The proposed fisheries monitoring plans incorporate multiple surveys utilizing a range of survey methods to assess different facets of the regional ecology and fisheries. For the Lease Area, these surveys include a demersal otter trawl survey, a benthic optical drop camera survey, a ventless trap survey, and a neuston tow survey (SMAST 2024). The demersal otter trawl survey, employing a tow speed of 3.0 knots and a tow duration of 20 minutes, would be used to evaluate the impacts of development on demersal fish populations. The benthic optical drop camera survey deploys three cameras (digital still and video) and estimates the substrate, as well as 50 different invertebrate and fish species that associate with the sea floor. A ventless trap survey would focus on assessing populations of American lobster, Jonah crab, and black sea bass in the SouthCoast Wind Lease Area while the neuston net survey would sample neustonic American lobster larvae and other large ichthyoplankton. Trawl surveys used to assess abundance and distribution of target fish and invertebrate species within the offshore Project area could affect a variety of fish and invertebrate species. The capture of fish species, including ESA-listed species like the Atlantic sturgeon, in trawl gear has the potential to result in injury and mortality, reduced fecundity, and delayed or aborted spawning migrations (Moser and Ross 1995; Collins et al. 2000; Moser et al. 2000). Capture of sturgeon in trawl gear could result in injury or death; however, the use of trawl gear is considered a safe and reliable method to capture sturgeon if tow and onboard handling times are limited (Beardsall et al. 2013). Drop camera surveys are non-intrusive sampling techniques, which are not expected to cause any impacts on fish, invertebrate, or EFH. Ropeless fishing gear would be deployed during the ventless trap survey meaning there would be no vertical downlines. The primary method for retrieving trap strings would be grappling, though on-demand systems would continue to be tested and potentially phased into the survey as the technology progresses and becomes logistically feasible. Bycatch of non-target species is possible during ventless trap surveys though bycaught organisms would be returned to the environment where practicable. The potential bycatch impact would be comparable to, but limited in extent relative to, the baseline level of impacts from commercial fisheries. Survey gear types placed on the seabed (e.g., traps) could also potentially disturb benthic habitats and epifauna (Schweitzer et al. 2018). However, any resulting disturbance would be minimal given the limited number or traps to be used and the small footprint of the survey gear.

A fisheries monitoring plan (INSPIRE 2023a) has also been developed for the portion of the Brayton Point ECC in Rhode Island state waters with acoustic telemetry and trap surveys as the primary monitoring methodologies. SouthCoast Wind would conduct acoustic telemetry monitoring along the Brayton Point ECC to monitor potential changes in the movements, presence, and persistence of several commercially and recreationally important species (e.g., striped bass, summer flounder, tautog, and false albacore) in response to cable installation activities. Acoustic telemetry methodologies have been used extensively in fisheries research (Hussey et al. 2015; Freiss et al. 2021) and mortality of tagged fish is expected to be low. SouthCoast Wind would also conduct a trap survey to monitor whelk relative abundance and size structure along commercially fished sections of the Brayton Point ECC in the Sakonnet River. The survey would identify potential impacts from the short-term disturbance of submarine cable installation on the localized channeled and knobbed whelk resources. The use of traps could result in unavoidable impacts on habitat-forming invertebrates that comprise an important component of habitat for some EFH species. The extent of habitat disturbance and number of organisms affected could be comparable to and limited in extent relative to the baseline level of impacts from commercial fisheries.

SouthCoast Wind has developed a benthic monitoring plan for benthic habitats in the Lease Area and the Brayton Point ECC to evaluate detectable post-construction changes (INSPIRE 2024). To assess the effect of the introduction of hard-bottom novel surfaces, an ROV stereo-camera system would be used to measure changes in benthic percent cover, identify key or dominant species, and document nonnative species. To evaluate structure-oriented enrichment and cable-associated physical disturbance, sediment grab samples and SPI/PV would be used to measure changes in benthic function over time with distance from foundations or distance from the cable centerline. During physical sampling (e.g., grab sampling), organisms captured would be removed from the environment for scientific analysis. Other non-target fish and invertebrate species could also be affected by sampling activities when survey equipment contacts the seafloor or when inadvertently captured as bycatch causing injury or death. Non-target organisms would be returned to the environment where practicable.

While project monitoring surveys would result in unavoidable impacts on individual finfish and invertebrates, the extent of habitat disturbance and number of organisms affected would be small compared to the baseline level of impacts from commercial fisheries and would not measurably affect the viability of any species at the population level. Any sampling activity would make use of a random sampling design making repeated disturbance of the same habitat unlikely. As such, habitat impacts from survey implementation would likely be short term. The intensity and duration of impacts anticipated from fisheries and benthic monitoring activities would constitute a short-term minor adverse effect on finfish, invertebrates, and EFH.**EMFs:** During operation, powered transmission cables would produce EMFs (Taormina et al. 2018). Depending on the type of cable used (AC or DC), the resulting EMFs would differ significantly in that AC transmissions vary rapidly in direction while DC transmissions are static (i.e., have a frequency of 0 Hz) (COP Appendix P2; SouthCoast Wind 2024). DC magnetic fields, such as those associated with submarine cables, can combine with the Earth's static geomagnetic field altering the direction and/or magnitude of the resulting EMFs. DC cable EMF interaction with the Earth's geomagnetic field will depend on the direction/orientation of the cable at the emplacement location (COP Appendix P2; SouthCoast Wind 2024). Additionally, DC cable EMFs average three times higher amplitude compared to those produced by AC cables (Hutchison et al. 2020b). To minimize EMFs generated by cables, cabling under the Proposed Action would include industry standard electric shielding (COP Volume 2, Table 16-1; SouthCoast Wind 2024). EMF strength rapidly decreases with distance from the cable (Taormina et al. 2018). SouthCoast Wind proposes to bury interarray and export cables to a target depth of 6 feet (1.8 meters). Due to variable conditions in the Lease Area and along the proposed ECC routes, the anticipated burial depth would range from 3.2 feet (1.0 meters) to 8.2 feet (2.5 meters) for interarray cables and from 3.2 feet (1.0 meters) to 13.1 feet (4.0 meters) for export cables, excluding asset crossings. This depth is well below the aerobic sediment layer where most benthic infauna live. EMF impacts would be greater in areas where cable burial depth meets only the lower end of the anticipated burial depth range or cannot be buried. However, EMF impacts would still be localized to the areas around the cables. EMF levels would be highest at the seabed and in the water column above cable segments that cannot be fully buried and are laid on the bed surface under protective rock or concrete blankets. Based on a preliminary understanding of the site conditions in the offshore export cable routes, SouthCoast Wind estimates that up to 10 percent of the length of the offshore export cables to Falmouth and 15 percent of the offshore export cables to Brayton Point, inclusive of cable crossing locations, may require cable protection.

The scientific literature provides some evidence of responses to EMFs by fish and mobile invertebrate species (Hutchison et al. 2018; Taormina et al. 2018; Normandeau Associates, Inc. et al. 2011), although recent reviews (CSA Ocean Sciences, Inc. and Exponent 2019; Gill and Desender 2020; Albert et al. 2020) indicate the relatively low intensity of the EMF associated with marine renewable projects would not result in impacts. Effects of an EMF may include interference with navigation that relies on natural magnetic fields, predator/prey interactions, avoidance or attraction behaviors, and physiological and developmental effects (Taormina et al. 2018). Behavioral response to DC EMFs has been found to be species-specific and varies by life stage. Demersal fish such as haddock (Cresci et al. 2022) and the larval stages of crustaceans (Harsanyi et al. 2022) are among the groups that have shown responses to EMF. Klimley et al. (2017) found that EMFs from a DC undersea power cable did not affect the migration success and survival of chinook salmon and green sturgeon, while Hutchison et al. (2018) noted that DC power cable EMF did not act as a barrier to the movement of the American lobster and little skate. In both studies, altered patterns of mobility were observed; however, these changes were temporary and did not interfere with migration success or population health.

CSA Ocean Sciences, Inc. and Exponent (2019) found that offshore wind energy development as currently proposed would have minor effects, if any, on bottom-dwelling finfish and invertebrates residing within the southern New England area. Although demersal biota are the most likely to be exposed to the EMF from power cables, potential exposure would be minimized because an EMF quickly decays with distance from the cable source (CSA Ocean Sciences, Inc. and Exponent 2019). Project-specific modeling confirmed that EMFs diminished rapidly with distance (COP Appendix P1; SouthCoast Wind 2024). In the case of mobile species, an individual exposed to an EMF would cease to be affected when it leaves the affected area. An individual may be affected more than once during long-distance movements; however, there is no information on whether previous exposure to an EMF would influence the impacts of future exposure. For pelagic species in the southern New England area, no negative effects were expected from offshore wind energy development as currently proposed because of their preference for habitats located at a distance from the seabed. Therefore, while EMFs emitted from operational cables would be present for the lifetime of the project, impacts on finfish, invertebrates, and EFH from EMFs from the Proposed Action would likely be localized and short term in the form of temporary alterations in mobility and behavior but with no appreciable effects on overall movement or population health.

BOEM expects impacts due to EMFs on finfish, invertebrates, and EFH would be minor because exposure to detectable EMFs would range from non-existent to short term throughout the life of the Project.

Lighting: Activities associated with the Proposed Action that could cause impacts from artificial lighting on finfish and invertebrates include presence of vessels throughout construction, operation, and decommissioning and navigation and safety lighting on offshore WTGs. Transiting and working vessels associated with construction would use artificial lighting during any operations outside of daylight hours. Light is generally considered an attractant to finfish (Marchesan et al. 2005); thus, it would be expected that areas where artificial light strikes and penetrates the ocean surface would experience increased fish activity, and finfish movement in highly localized areas would be affected. Artificial lighting can also affect natural reproductive cycles for finfish, such as spawning; however, light would need to be persistent and present for long periods of time to influence natural reproductive cycles (Longcore and Rich 2004). Light sources from the Project would involve obstruction lights on the nacelle and mid-mast, which are characterized by intermittent flashes of red hues, and marine navigational lights, which are characterized by intermittent flashes of yellow hues, neither of which present a continuous light source. Lighting may also result in impacts on normal behavior of fish and pelagic eggs and larvae by altering their movement and potentially causing temporary increases in predation pressure and disruption of normal swimming behavior, where light may be an attractant to finfish. Zooplankton diel migration and movement may be also influenced by changes in light exposure. Artificial light would be minimized to the extent practicable through use of BMPs. Furthermore, potential impacts from lighting would be anticipated to have little impact on finfish and invertebrates during daylight hours and would be limited by the depth of the water in the offshore Project area.

The cumulative impacts of light on finfish, invertebrates, and EFH are likely to be localized and short term, resulting in little change to these resources. As such, artificial light impacts associated with the proposed action would be considered negligible.

Noise: Activities associated with the Proposed Action that could cause underwater noise effects on finfish and invertebrates are pile driving, vessel traffic, aircraft, geophysical surveys (HRG surveys and geotechnical surveys), WTG operation, cable installation, foundation removal, and seabed preparation activities. Pile driving during construction and UXO detonation, should it occur, would produce the most intense underwater noise impacts with the greatest potential to cause injury and behavioral effects on finfish and invertebrates, noise from HRG surveys and vessels could result in behavioral effects, and operational WTG noise would occur over the longest duration; therefore, these effects are the focus of the following Proposed Action assessment.

Impacts from sound vary based on the intensity of the noise and the method of sound detection used by the animal. Impacts can range from minor behavioral alterations, such as temporary displacement or temporary disruption of normal activities (e.g., feeding, movement), to physiological reactions, such as ruptured capillaries in fins, hemorrhaging of major organs, or burst swim bladders (Popper et al. 2014), which could lead to mortality. Assessment of the potential for underwater noise to injure or disturb a fish or invertebrate requires acoustic thresholds against which received sound levels can be compared. Available injury thresholds for fish were developed by the Fisheries Hydroacoustic Working Group (2008) and Popper et al. (2014) and are provided in **Error! Reference source not found.**.

Table 3.5.5-7. Acoustic metrics and thresholds (dB) for fish currently used by NMFS and BOEM for impulsive pile driving

Faunal Group	Onset of Physical Injury		Behavioral Disturbance LP
	Injury Lpk	Injury LE	
Fish equal to or greater than 2 grams [a,b]	206	187	150
Fish less than 2 grams [a,b]	206	183	150
Fish without swim bladder [c]	213	216	150
Fish with swim bladder not involved in hearing [c]	207	203	150
Fish with swim bladder involved in hearing [c]	207	203	150

Note: NMFS does not have physical injury thresholds for non-impulsive sources, except tactical sonar
dB = decibels; L_{pk} = peak sound pressure level in decibels referenced to 1 microPascal squared; also written as SPL_{pk};
L_E = weighted cumulative sound exposure level in decibels referenced to 1 microPascal squared second; also written SEL_{cum};
L_p = root mean squared sound pressure level in decibels referenced to 1 microPascal squared; also written SPL_{rms} or L_{rms}
[a] NMFS recommended criteria adopted from the Fisheries Hydroacoustic Working Group 2008.
[b] Andersson et al. 2007; Mueller-Blenkle et al. 2010; Purser and Radford 2011; Wysocki et al. 2007.
[c] Popper et al. 2014.

Noise thresholds for invertebrates have not been developed because of a lack of available data. In general, mollusks and crustaceans are less sensitive to noise-related injury than many fish because they lack internal air spaces and are less susceptible to over-expansion or rupturing of internal organs, the typical cause of lethal noise related injury in vertebrates (Popper et al. 2001). Current research suggests that some invertebrate species groups, such as cephalopods (e.g., octopus, squid), crustaceans (e.g., crabs, shrimp), and some bivalves (e.g., scallops, ocean quahog) are capable of sensing sound through particle motion (Carroll et al. 2016; Edmonds et al. 2016; Hawkins and Popper 2014). Studies of the effects of intense noise sources on invertebrates, similar in magnitude to those expected from Project construction, found little or no measurable effects even in test subjects within 3.3 feet (1 meter) of the source (Edmonds et al. 2016; Payne et al. 2007). Jones et al. (2020, 2021) evaluated squid sensitivity to high-intensity impulsive sound comparable to monopile installation. They observed that squid displayed behavioral responses to particle motion effects within 6.6 feet (2 meters) of high-intensity impulsive noise. They further theorized that squid in proximity to the seabed might be able to detect particle motion from impact pile driving imparted through sediments several hundred meters from the source, eliciting short-term behavioral responses lasting for several minutes.

Other researchers have found evidence of cephalopod sensitivity to continuous low frequency sound exposure comparable to sound sources like vibratory pile driving (Andre et al. 2011). Solé et al. (2018, 2022) exposed various species of cephalopod larvae to underwater noise comparable to impact pile driving and observed similar statocyst injuries that were likely to negatively affect survival. Solé et al. (2022) found that exposure to impact pile driving noise above 170 dB re 1 μPa^2 caused observable damage to statocysts in cuttlefish larvae, and that those effects could be attributed to the sound pressure (versus particle motion) component of noise. That damage resulted in an apparent reduction in survival and reduced response to predator stimuli in the developing larvae. Solé et al. (2018) observed similar statocyst damage in two species of squid exposed to maximum peak noise levels of 175 dB re 1 μPa. From an underwater acoustic assessment conducted in the SouthCoast Wind Lease Area (Limpert et al. 2024), modeling results showed that pile-driving noise above 170 dB re 1 μPa^2 can reach a radial distance of up to 13 kilometers from the foundation site (Table 3.5.5-8). Within this distance, injury-level effects on cephalopods from cumulative exposure could potentially occur.

The current underwater noise thresholds consider effects on fish mainly through sound pressure, without taking into consideration the effect of particle motion. Popper et al. (2014) and Popper and Hawkins (2018) suggest that extreme levels of particle motion induced by various impulsive sources may also have the potential to affect fish tissues and that proper attention needs to be paid to particle motion as a stimulus when evaluating the effects of sound on aquatic life. However, thresholds for particle motion exposure are not currently available as this component of sound is still understudied due to the difficulty in measuring and modeling particle motion, and the lack of experimental data on its effects (Popper and Hawkins 2018).

Particle motion in the substrate resulting from compressional, shear, and interference waves generated by pile driving or turbine operation is another understudied component of sound propagation in the marine environment (Hawkins et al. 2021). Fish and invertebrates living close to or within the substrate sediment (e.g., sand lances) may potentially detect particle motion associated with substrate motion. However, there is limited knowledge on how fishes and invertebrates detect and respond to substrate vibration, the species-specific detection capabilities and sensitivities, and potential behavioral effects (Hawkins et al. 2021). More research is required to measure and determine the levels of substrate vibration and particle motion that may affect infaunal and bottom-oriented organisms as these may vary substantially between species (Hawkins et al. 2021).

Notably, there are no acoustic threshold criteria for fish for non-impulsive noise sources like vibratory pile driving. Sound pressure levels (SPL) generated from vibratory-driven piles would be higher near the seabed surface than elsewhere in the water column (Tsouvalas and Metrikine 2016) and could have physiological and behavioral impacts on fish and aquatic invertebrates living near or in the seabed such as the Atlantic sturgeon.

Table 3.5.5-8. Acoustic radial distances ($R_{95\%}$ in kilometers) for fish during pile driving under various scenarios at the higher impact of two modeled locations for both seasons, with 10-dB noise attenuation from a noise-abatement system

Faunal Group	Unit	Threshold Level	Location 1			Location 2		
			16 m Monopile Scenario, NNN 6600 (b) hammer	4.5 m Pre-piled Jacket Scenario, MHU 3500S (b) hammer	4.5 m Post-piled Jacket Scenario, MHU 3500S (b) hammer	16 m Monopile Scenario, NNN 6600 (b) hammer	4.5 m Pre-piled Jacket Scenario, MHU 3500S (b) hammer	4.5 m Post-piled Jacket Scenario, MHU 3500S (b) hammer
Acoustic Radial Distances to Thresholds ($R_{95\%}$ in kilometers) during Winter								
Behavioral (all fish) [b]	L_p	150 dB	17.22	10.79	13.02	12.35	9.11	11.07
Single Strike Injury (all fish) [a]	L_{pk}	206 dB	0.15	0.05	0.06	0.11	0.05	0.06
Injury over 24hr (fish ≥ 2 grams) [a]	L_E	187 dB	9.68	6.83	8.21	7.69	5.36	6.30
Injury over 24hr (fish < 2 grams) [a]	L_E	183 dB	13.19	9.63	11.78	10.10	7.48	8.74
Acoustic Radial Distances to Thresholds ($R_{95\%}$ in kilometers) during Summer								
Behavioral (all fish) [b]	L_p	150 dB	13.86	9.28	10.99	9.69	7.34	8.34
Single Strike Injury (all fish) [a]	L_{pk}	206 dB	0.14	0.05	0.06	0.11	0.05	0.06
Injury over 24hr (fish ≥ 2 grams) [a]	L_E	187 dB	8.50	6.31	7.34	6.51	4.77	5.48
Injury over 24hr (fish < 2 grams) [a]	L_E	183 dB	10.99	8.50	9.63	8.26	6.26	7.17

Cumulative sound exposure level values were calculated for a 24-hour period. Values shown were at the middle (b) hammer energy.

L_{pk} = peak sound pressure level in decibels referenced to 1 microPascal squared; also written as SPL_{pk}; L_E = weighted cumulative sound exposure level in decibels referenced to 1 microPascal squared second; also written SEL_{cum}; L_p = root mean squared sound pressure level in decibels referenced to 1 microPascal squared; also written SPL_{rms} or L_{rms}

[a] NMFS recommended criteria adopted from the Fisheries Hydroacoustic Working Group (FHWG 2008).

[b] Andersson et al. (2007), Mueller-Blenkle et al. (2010), Purser and Radford (2011), Wysocki et al. (2007).

Source: Summarized from Tables 50–55 in Limpert et al. (2024).

Studies aimed at predicting the wave field emitted by impact- and vibratory-driven monopiles using traditional and novel noise-prediction models underscores the assumption that the highest noise levels occur just above the seabed (Tsouvalas and Metrikine 2016; Molenkamp et al. 2024). This effect is more pronounced in vibratory pile driving due to the energy carried by Scholte waves that propagate at the water-sediment interface and create an evanescent sound field within the water column (Hazelwood and Macey 2021). These waves become particularly dominant under low-frequency excitation, consistent with the primary driving frequency range (10–40 Hz) during vibratory pile driving (Tsouvalas and Metrikine 2016).

Noise - impact and vibratory pile driving: The primary impacts of noise on finfish and invertebrates would occur during offshore construction activities associated with the Proposed Action. Primary noise impacts would occur from pile-driving activities. Research has shown that finfish can suffer behavioral and physiological effects based on received sound levels, distance from the noise, and variables related to the noise-producing impact (e.g., materials, size of hammer). Under the Proposed Action, noise from pile driving could affect the same populations or individuals multiple times over the time that pile driving would occur though it is currently unknown whether it would have less impact to drive many piles sequentially or concurrently. As introduced in Section 3.5.5.3, invertebrates may also exhibit behavioral and physiological responses to noise exposure though available studies on the effects of wind farm specific noise sources on invertebrates are limited and knowledge gaps in this field of research remain (Solé et al. 2023).

Noise from impact and vibratory pile driving for the installation of WTGs and OSP foundations would occur intermittently during the installation of offshore structures. A maximum total of 147 WTGs and five OSPs at a maximum of 149 WTG/OSP positions are anticipated for the Proposed Action. Each WTG requires one monopile or 4 pin piles for jacket foundations and each OSP requires one monopile or up to 27 pin piles, with each pin pile or monopile requiring 2 or 4 hours of driving to install, respectively. An estimated total of 792 hours of installation time would be needed for 86 monopile WTG foundations and 2 OSPs in one construction season, with no pile driving occurring between January 1 and April 30 (LGL 2024; Appendix G, Attachment G-3).

Acoustic propagation modeling of the impact pile-driving activities for the Proposed Action was undertaken by JASCO Applied Sciences (Limpert et al. 2024) to determine distances to the established fish injury and disturbance thresholds and provided as Appendix A to the *Petition for Incidental Take Regulations* for the Project (LGL 2024). The acoustic model considered tapered monopiles that are 52 feet (16 meters) in diameter at the expected waterline and jacket foundations with 15-foot (4.5-meter)-diameter jacket pin piles. Sound fields from 52-foot (16-meter) monopiles and 15-foot (4.5-meter) jacket pin piles were modeled at two representative locations in the Lease Area using a 6,600-kilojoule impact hammer and a 3,300-kilojoule impact hammer, respectively. The modeling also applied a 10-dB-per-hammer-strike noise attenuation, which is considered achievable with currently available technologies (Bellmann et al. 2020). The modeling results represent a radius extending around each pile where potential injurious-level or behavioral effects could occur and are presented in Table 3.5.5-8.

Single-strike peak sound pressure (SPL_{PK}) injury distances represent how close a fish would have to be to the source to be instantly injured by a single pile strike. The cumulative injury distances based on sound exposure level (SEL_{cum}) consider total estimated daily exposure, meaning a fish would have to remain within that threshold distance over the entire daily period of installation to experience injury. The exposure distances for behavioral effects (SPL_{RMS}) can be met without prolonged exposure, meaning that any animal within the effect radius is assumed to have experienced behavioral effects.

The likelihood of injury from monopile installation depends on proximity to the noise source, intensity of the source, effectiveness of noise-attenuation measures, and duration of noise exposure. Modeling results (Table 3.5.5-8) indicate that acoustic radial distances were generally smaller at Location 2 and during the summer. Results modeled at Location 1 in the winter show that noise levels exceeding the injury threshold from a single strike is limited to 0.09 mile (0.15 kilometer) from the monopile, 0.03 mile (0.05 kilometer) from pre-piled jacket pin piles, and 0.04 mile (0.06 kilometer) from the post-piled jacket pin piles. For fish greater than 2 grams, injury from prolonged cumulative exposure (24 hours), assuming 10 dB of attenuation is applied, extends as far as 6 miles (9.68 kilometers) during monopile driving, 4.2 miles (6.83 kilometers) for pre-piled jacket pin pile driving, and 5.1 miles (8.21 kilometers) for post-piled jacket pin pile driving. For fish less than 2 grams, cumulative exposure in the winter is expected at distances between 8.2 miles (13.19 kilometers) for monopile driving, 5.9 miles (9.63 kilometers) for pre-piled jacket pin pile driving, and 7.32 miles (11.78 kilometers) for post-piled jacket pin pile driving. Results modeled in Location 1 indicate that behavioral effects on fish could occur between 5.8 and 10.7 miles (9.3 and 17.2 kilometers) depending on the season and equipment (monopile vs. jacket pin pile), with monopile installation in the winter having the greatest acoustic range. Within this area, it is likely that some level of behavioral reaction is expected and could include startle responses or migration out of areas exposed to underwater noise (Hastings and Popper 2005). Behavioral disturbance to fish from pile-driving noise is therefore considered temporary for the duration of the activity.

For Atlantic sturgeons, the distance to pile driving sound levels that could exceed recommended injury thresholds (fish ≥ 2 grams = 206 decibel SPLpk) is 0.09 mile (0.15 kilometer) for single strikes and within up to 6.03 miles (9.7 kilometers) for cumulative exposure (187 decibels SELcum) during monopile driving, assuming 10 dB of noise attenuation (Table 3.5.5-8). During pin pile driving, the distance to pile driving sound levels that could exceed recommended Atlantic sturgeon injury thresholds (206 decibel SPLpk) is 0.03 mile (0.05 kilometer) for single strikes for pre-piled pin pile driving and within up to 5.1 miles (8.2 kilometers) for cumulative exposure (187 decibels SELcum) for post-piled pile driving with 10 dB of noise attenuation. Based on these results, to be exposed to potentially injurious levels of noise during pile driving, the Atlantic sturgeon would need to be within 5.1 to 6.03 miles (8.2 to 9.7 kilometers) of the pile being driven for a prolonged period. However, due to the dispersed nature of Atlantic sturgeon in the offshore environment and the likelihood of animals moving away from disturbance, it is unlikely that sturgeon will be exposed to injurious noise levels.

Currently there are no established thresholds for continuous noise sources as vibratory piling is currently classified. Additionally, the distance to injury and the distance to behavioral modification are less than impact piling when using the criteria for impulsive sound sources. As such vibratory pile driving generally poses less of an acoustic impact to fish compared to impact pile driving because of the non-impulsive nature of the underwater noise produced by vibratory pile driving. Unlike impact pile driving, which is classified as an impulsive sound source, vibratory pile driving produces a gradual increase in noise levels that is 10 to 20 dB lower than that of impact pile driving (Buehler et al., 2015). Atlantic sturgeon that may be present within the ensonified area and exposed to sound levels above the behavioral threshold. However, due to the dispersed nature of Atlantic sturgeon in the offshore environment and the likelihood of animals moving away from disturbance, it is unlikely that sturgeon will be exposed to sound levels exceed the physiological threshold during vibratory pile driving.

Biological cues used by soniferous fishes for communication may also be masked potentially disrupting foraging and breeding (Mooney et al. 2020) while pile driving is ongoing. Underwater noise sufficient to alter behavior could have disruptive effects on Atlantic cod spawning (Dean et al. 2012), especially at night, as Atlantic cod courtship and spawning behaviors occur primarily at night (Dean et al. 2014; Zemeckis et al. 2019). However, once the environmental stressor (noise) is discontinued, the masking stops. Additionally, brief disturbance may not necessarily disrupt Atlantic cod spawning. For example, Morgan et al. (1997) observed the dispersal of a spawning aggregation of Atlantic cod by the passage of a single bottom trawl for a brief period (approximately 1 hour), after which the aggregation returned to the affected area and resumed spawning. In another study, McQueen et al. (2022) observed that exposure to seismic airgun noise did not cause displacement of Atlantic cod from their spawning grounds. They speculated that strong site affinity could explain the lack of a significant behavioral response to an otherwise intensive stressor. These contrasting findings suggest that short-term periods of disturbance may not necessarily result in adverse effects on Atlantic cod spawning. Similarly, recent research suggests that longfin squid spawning may not be adversely affected by pile-driving noise. In laboratory experiments where longfin squid were exposed to recordings of pile-driving noise from the installation of the Block Island Wind Farm, longfin squid did not demonstrate significant changes in reproductive behaviors (Stanley et al. 2023). The results from this study suggest that noise exposure is potentially more disruptive to squid feeding behavior and anti-predator responses than to spawning activity.

To mitigate noise impacts to the extent practicable, the Project would use a noise attenuation system that achieves at least 10 dB reduction in sound levels and would employ soft starts during impact pile driving, allowing a gradual increase of hammer blow energy and, thus, allowing mobile marine life to leave the area. Time-of-year restrictions may also be employed to limit construction noise exposure to soniferous species, such as Atlantic cod, and to avoid disrupting spawning aggregations that may form within the Project area (Nantucket Shoals). With these measures in place, injuries to fish and invertebrates are expected to be spatially localized, but impact periods would range from short term to potentially permanent. Therefore, impacts from pile driving on finfish, invertebrates, and EFH are anticipated to be moderate.

Noise - G&G survey (HRG surveys and geotechnical drilling activities): Geotechnical surveys have taken place prior to construction from 2019 to 2022 (Table 4-2, COP Vol. 2, SouthCoast Wind 2024), with no geotechnical surveys planned to occur during the construction or post-construction phases. These surveys were conducted to identify sensitive habitats (e.g. shellfish, SAV beds) and allow areas to be avoided to the extent practicable for siting of WTGs, OSPs, and cable routes. However, if specific locations of certain Project components differ from the previously surveyed layout, SouthCoast Wind would perform additional geotechnical investigations at any new locations not already covered by previous investigations. High-resolution geophysical (HRG) surveys would be conducted intermittently during construction to identify any seabed debris and provide general construction support. These surveys would include equipment operating at less than 180 kilohertz such as multi-beam echosounders, sidescan sonars, shallow penetration sub-bottom profilers (e.g., “Chirp”, parametric, and non-parametric sub-bottom profilers), medium penetration sub-bottom profilers (e.g., sparkers), ultra-short baseline positioning equipment, and marine magnetometers. HRG surveys will be carried out on a routine basis during the 3 years following the first 2 years of construction, which is termed the “operations phase” in the Project’s Incidental Take Regulations (LGL 2024).

Seismic noise from G&G surveys has been shown to create varying behavioral responses in fish. These responses in fishes have been documented but careful evaluations of their impacts and examinations of physiological injury are lacking (Carroll et al. 2016). Behavioral impacts on finfish from Project-related G&G surveys would also be localized and temporary. Mobile, intermittent, non-impulsive HRG survey sound sources, such as multi-beam echosounders and side-scan sonar, are not likely detectable by Atlantic sturgeon because they operate above the hearing sensitivity of this species (above 1 kilohertz) making the potential for auditory injury and behavioral disturbance unlikely.

For the HRG systems proposed for the Project, the distance to injury for fish was 13 feet (4 meters) for the sparker and 8.2 feet (2.5 meters) for the boomer (Table 3.5.5-9). During HRG surveys using impulsive equipment, finfish and invertebrates close to sparkers and boomers may experience temporary displacement (BOEM 2021). This type of behavioral impact would be localized to within 1,847 to 2,070 feet (563 to 631 meters) of the sound source and would be short term in duration. Finfish and invertebrates in the general area but not in the immediate vicinity of the sound source could experience short-term stress and temporary behavioral changes in a larger area affected by the sound.

Table 3.5.5-9. Impulsive HRG equipment source levels and associated PTS and behavioral disturbance distances for fish

Equipment	System	Highest Source Level (dB re 1 μPa)		PTS Distance (m) for Fish		Behavioral Disturbance Distance (m) for Fish
		L_{pk}	L_E	L_{pk}	L_E	
Sparker	SIG ELC 820 @ 750 J	213	182	4.0	0	631
Sub-bottom profiler	Teledyne Benthos Chirp III [a]	204	193	NA	NA	32
Boomer	Applied Acoustics S-boom @ 700 J	211	172	2.5	0	563

[a] Measured highest source levels were not provided for this exact system, so used generalized values for chirp sub-bottom profilers from Table 1 in NMFS 2021c.
dB = decibel; HRG = high resolution geophysical; m = meters; PTS = permanent threshold shift; L_{pk} = peak sound pressure level in decibels referenced to 1 microPascal squared; also written as SPL_{pk}; L_E = weighted cumulative sound exposure level in decibels referenced to 1 microPascal squared second; also written SEL_{cum}; NA = not applicable due to the sound source being out of the hearing range for the group
Source: NMFS 2021c: Table 1 and Tables A.2–A.5.

With the implementation of measures that would help mitigate the effects of HRG survey activities, the potential for serious injury is minimized. For example, ramp-up procedures would facilitate a gradual increase of equipment energy that would allow the finfish to avoid the area prior to the start of operations. In addition, as the survey equipment was secured to the survey vessel or towed behind a survey vessel and only turned on when the vessel is traveling along a survey transect, the potential effects would be transient and intermittent.

General vessel noise is produced from vessel engines and dynamic positioning to keep the vessel stationary while equipment is deployed and sampling is conducted for these surveys. BOEM's regulations and guidance under 30 CFR 585.626 and 585.627 require the lessee to submit detailed G&G data and analysis, among other data requirements to establish engineering and other construction parameters, and the G&G activities are, therefore, mandatory.

Considering the very small injury zones, the implementation of ramp-up procedures and the transient nature of the effect, the potential for finfish, including the Atlantic sturgeon, to be exposed to noise sources above physiological thresholds is considered extremely unlikely to occur. Effects of brief exposure above behavioral thresholds could result in temporary displacement from opportunistic feeding areas; however, the effects would be too small to be meaningfully measured. Therefore, noise exposure from HRG surveys is expected to have short-term and minor impacts on finfish, invertebrates, and EFH.

Noise - turbine operation: Offshore WTGs produce continuous, non-impulsive underwater noise during operation, mostly in lower-frequency bands below 8 kilohertz. There are several recent studies that present sound properties of similar turbines in environments comparable to that of the Proposed Action. Field measurements during operations indicate that sound levels are much lower than during construction; on average broadband root-mean-square sound pressure levels (SPL or L_{rms}) measured 164 feet (50 meters) from a Block Island Wind Farm turbine on average were 119 dB re 1 µPa and tonal peaks were observed at 30, 60, 70, and 120 Hz (Elliott et al. 2019). The Block Island Wind Farm turbines are 6 MW, direct-drive, four-legged jacket-pile structures. At the Block Island Wind Farm in winter, a 71 Hz constant tone was measured 328 feet (100 meters) from a turbine. In summer, sound levels increased between 70 Hz to 120 Hz. The maximum particle velocity during operations (as measured 328 feet [100 meters] from the turbine, just above the seabed) in winter was 40 dB re 1 nanometer per second, while in summer it was closer to 90 dB re 1 nanometer per second; most of the energy was below 25 Hz (Elliott et al. 2019). Overall, results from this study indicate that there is a correlation between underwater sound levels and increasing wind speed, but this is not clearly influenced by turbine machinery; rather it may be the natural effects that wind and sea state have on underwater sound (Elliott et al. 2019; Urick 1983). Furthermore, a recent compilation of operational noise from several wind farms with turbines up to 6.15 MW in size, showed that operational noise generally attenuates rapidly with distance from the turbines (falling below normal ocean ambient noise within 0.6 mile [1 kilometer] from the source), and the combined noise levels from multiple turbines is lower or comparable to that generated by a small cargo ship (Tougaard et al. 2020). Larger turbines (>10 MW) do produce higher levels of operational noise, and the least squares fit of that dataset would predict that an SPL measured 328 feet (100 meters) from a hypothetical 15 MW turbine in operation in 10 meters per second (19 knots or 22 miles per hour) wind would be 125 dB re 1 µPa. However, all of the turbines in the dataset, apart from the Block Island Wind Farm, were operated with gear boxes of various designs that did not use newer direct-drive technology that is expected to lower noise levels significantly. Stöber and Thomsen (2021) noted that the Block Island Wind Farm, using direct drive, is expected to be approximately 10 dB quieter than other equivalent sized jacket-pile turbines. Based on the Tougaard et al. 2020 dataset, operational noise from jacket piles could be louder than from monopiles due to there being more surface area for the foundation to interact with the water; however, the paper does point out that received level differences among different pile types could be confounded by differences in water depth and turbine size. Therefore, additional data are needed to fully understand the effects of size, foundation type, and drive type on the amount of sound produced during turbine operation.

Other studies have concluded that operational noise from WTGs is detected by finfish and can affect their behavior. For example, the particle motion generated at a WTG foundation from the turbine operation was found to generate relatively strong broadband sounds, as well as tones likely to induce behavioral responses by fishes, such as cod and plaice in the Baltic Sea (Hawkins 2020). Westerberg (1994, as cited in Mooney et al. 2020) reported on increased catchability of cod and roach (*Rutilus rutilus*) within 100 meters of a stopped WTG (i.e., with no noise) as compared to an operating WTG (i.e., with noise). WTG noise frequency and level were found to overlap with the auditory sensitivity of the marbled rockfish (*Sebastiscus marmoratus*), indicating turbine noise could be detected by fish and may have a masking effect on their acoustic communication (Zhang et al. 2021).

Based on the current source levels discussed above, it is unlikely that received levels of underwater noise from WTG operations would exceed physiological injury thresholds for finfish. However, sensitive species may be exposed to operational WTG noise levels that exceed temporary threshold shift (TTS) and behavioral thresholds when coupled with high wind events that increase ambient underwater noise levels. While the exact WTG type and supplier have not been finalized, SouthCoast Wind is currently considering the use of both direct drive and gear-driven current-generation turbines. The likelihood of exposure beyond TTS and behavioral thresholds may be higher particularly if larger (>10 MW), gear-driven WTGs would be installed under the Proposed Action. However, more acoustic research is warranted to characterize sound levels originating from larger turbines, the potential for those turbines to cause TTS effects, and to what distance behavioral and masking effects are likely. Operational noise effects are likely to be of low intensity and highly localized and are anticipated to attenuate to ambient levels within a close range of each foundation. Therefore, based on best available information, it is anticipated that operational noise from WTGs under the Proposed Action would have long-term but minor impacts on finfish, invertebrates, and EFH.

Noise – vessels: It is estimated that the Project would require approximately 15 to 35 vessels per day on average during construction, with an expected maximum peak of 50 vessels in the Lease Area at one time. These vessels generate low-frequency (10 to 100 hertz) (MMS 2007) non-impulsive, continuous noise. While received sound source levels from vessel noise are unlikely to exceed physiological injury thresholds for finfish and invertebrates, it may induce acoustic masking in soniferous fish, such as haddock (*Melanogrammus aeglefinus*) and cod (Vasconcelos et al. 2007). Continuous sounds produced by marine vessels have also been reported to change fish behavior; causing fish to change speed, direction, or depth; induce avoidance of affected areas by fish; or alter fish schooling behavior (Engås et al. 1995, 1998; Sarà et al. 2007; De Robertis and Handegard 2013; Mitson and Knudsen 2003). High levels of low-frequency noise (from 10 to 1,000 hertz) may be responsible for inducing an avoidance reaction (Sand et al. 2008). Popper et al. (2014) suggest that in response to continuous sounds, Atlantic sturgeon have a moderate risk for behavioral disturbance in the near field (e.g., tens of meters) and intermediate field (hundreds of meters) and low risk in the far field (thousands of meters). Masking effects are considered high risk in the near and intermediate field and moderate in the far field and TTS effects are considered of moderate risk in the near field and low in the intermediate and far fields. Vessel noise may also induce physiological stress and impair foraging and predator responses in both fish and invertebrates. Benthic feeders, such as the Atlantic sturgeon are unlikely to be affected while foraging by a transient vessel noise source. While these behavioral effects are considered possible, vessel noise would only result in brief periods of exposure near the surface of the water column and would not be expected to cause injury, hearing impairment, or long-term masking of biologically relevant cues in finfish and invertebrates. Consistent with this, BOEM determined that adverse impacts on finfish and invertebrates from noise generated by vessel transit and operations are not expected (BOEM 2018).

Given that the effects from vessel noise are expected to be temporary and localized, impacts of vessel noise to finfish, invertebrates, and EFH are, therefore, considered to be minor with no consequences on the population level.

Noise - UXO detonation: In addition to operational noises described above, there is a potential for interactions with UXOs, as well as the corrosion of UXOs in the Lease Area. The risk for encountering UXOs is moderate throughout all of the Lease Area, and a relatively equal ratio between low and moderate within the ECCs (COP Appendix E.7, SouthCoast Wind 2024). While non-explosive methods may be employed to lift and move these objects, some may need to be removed by explosive detonation. Underwater explosions of this type generate high pressure levels that could kill, injure, or disturb fish species, including ESA-listed species like the Atlantic sturgeon.

The exact number and type of UXOs in the Project area are not yet known, but SouthCoast Wind conservatively estimates that up to five UXOs in the Lease Area and up to five along the ECCs may have to be detonated in place. To avoid times when marine mammal species are more likely to be present, UXO detonations are only planned to occur from May through November, which will also benefit finfish and invertebrate species in these areas. Injury to fish from exposures to blast pressure waves is attributed to compressive damage to tissues surrounding the swim bladder and gastrointestinal tract, which may contain small gas bubbles. Effects of detonation pressure exposures to fish have been assessed in Hannay and Zykov (2022) according to the L_{pk} limits for onset of mortality or injury leading to mortality due to explosives, as recommended by the American National Standards Institute (ANSI) expert working group (Popper et al. 2014) and provided in Table 3.5.5-10. The injurious effects thresholds for all fish species groups are the same: L_{pk} = 229–234 dB re 1 µPa. For fish species that use swim bladders for hearing, Popper et al. (2014) suggest a high likelihood of TTS and recoverable injury at near and intermediate distances, where near refers to within a few tens of meters and intermediate refers to a few hundreds of meters. For fish species with swim bladders not used for hearing, the guidelines indicate high likelihood of recoverable impairment at near and intermediate distances but low levels of TTS at intermediate distances. For fish without swim bladders, the guidelines indicate low likelihood of recoverable injury at intermediate distances, moderate likelihood of TTS at intermediate distances, and low levels of both effects at far distances of a few kilometers (Table 3.5.5-10).

Table 3.5.5-10. Effects of detonation pressure exposures on fish

Type of Animal	Onset of Mortality	Onset of Physical Injury	Recoverable Injury	Temporary threshold shift (TTS)	Masking	Behavior
Fish: no swim bladder (particle motion detection)	229 – 234 dB (LPK)	206 dB (LPK) 187 dB (LE)	(N) High (I) Low (F) Low	(N) High (I) Moderate (F) Low	N/A	(N) High (I) Moderate (F) Low
Fish where swim bladder is not involved in hearing (particle motion detection)			(N) High (I) High (F) Low	(N) High (I) Moderate (F) Low		(N) High (I) High (F) Low
Fish: where swim bladder is involved in hearing (primarily pressure detection)			(N) High (I) High (F) Low	(N) High (I) High (F) Low		(N) High (I) High (F) Low

Note: N = near (distance within a few tens of meters), I = intermediate (distance within a few hundreds of meters), F= far (distance within a few kilometers).
Lpk = peak sound pressure level in decibels referenced to 1 microPascal squared; also written as SPLpk; LE = frequency weight sound exposure level in decibels referenced to 1 microPascal squared second; also written as SEL.
Sources: Hannay and Zykov 2022; Popper et al. 2014.

The greatest exceedance distance to the onset of injury for the largest UXO size (454 kg) with no noise mitigation measures is 2,779 feet (847 meters) (Table 3.5.5-11). During UXO detonation, noise mitigation would be required, and the likely achieved noise mitigation would be approximately 10 dB. Results show that when mitigation measures are applied, the maximum distance to the onset of injury threshold exceedance for the largest UXO size is reduced to 290 meters from the source, thereby, further reducing the risk of injury to fish from UXO detonation (Table 3.5.5-11). Implementation of mitigation measures coupled with the unlikely detonation of UXO, the low number of potential detonations required for the Proposed Action (modeled for no more than 10), further reduces the potential for exposure to finfish and invertebrates. Thus, the risk of injury or behavioral disturbance from UXO detonation is low, and impacts on finfish, invertebrates, and EFH, should they occur, are anticipated to be **minor** with no effects on the population level.

Table 3.5.5-11. Unmitigated and mitigated maximum exceedance distances for onset of injury for fish without and with a swim bladder due to peak pressure exposures for various UXO sizes

Species	Onset Injury L_{pk} (dB re 1 µpa)	All sites: Maximum distance to L_{pk} onset injury threshold exceedance (m)				
		E4 (2.3 kg)	E6 (9.1 kg)	E8 (45.5 kg)	E10 (227 kg)	E12 (454 kg)
All fish hearing groups (unmitigated)	229	145	230	393	671	847
All fish hearing groups (10 dB mitigation)	229 [a]	49	80	135	230	290

[a] The threshold of 229 dB re 1 µPa is from Popper et al. (2014).
dB = decibel; kg = kilogram; m = meter; UXO = unexploded ordnance; L_{pk} = peak sound pressure level in decibels referenced to 1 microPascal squared; also written as SPL_{pk}
Source: Hannay and Zykov 2022: Table 22 and Table 45.

Presence of structures: Various impacts on finfish, invertebrates, and EFH resulting from the presence of new structures associated with the Proposed Action are described in detail in Section 3.5.5.3. The Proposed Action would include up to 149 WTG/OSP positions, which would be constructed in mostly sandy seafloor areas. The size of the impact area would vary based on construction design (i.e., monopile, jacket, or suction bucket foundation). The primary impact would be from the foundations, which would be constructed in mostly soft-bottom seafloor, creating new habitat in the water column and transforming small portions of EFH. New structures could affect finfish and invertebrate migration through the area by providing unique complex features (relative to the primarily soft-bottom seafloor) and altering water currents. This could lead to retention of those species and possibly affect spawning opportunities. Impacts on fish migration as a result of structures associated with offshore wind are unknown, as studies related to this potential impact are not available.

New complex structures could result in additional impacts such as aggregation of fish, entanglement, gear loss, and habitat conversion. These impacts would be highly localized but could be long term for those structures that are not removed. Wind turbine structures would create an artificial reef effect, whereby more sessile and benthic organisms such as mussels, barnacles, anemones, and algae would likely colonize these structures over time creating new trophic pathways (De Mesel et al. 2015). Higher densities of invertebrate colonizers would provide a food source and habitat to other invertebrates such as mobile crustaceans. Additionally, new structures could be beneficial to some finfish and invertebrate species, providing potential feeding grounds and areas of protection from predators. In a synthesis study on the reef effect occurring in European and American offshore wind farms in the North Atlantic, Degraer et al. (2020) found that species densities, biological diversity, and biomass all increased in the soft-bottom communities nearest the turbine foundation. Methratta and Dardick (2019), in their meta-analysis of the effects of wind farm structures on fish populations, observed an almost universal increase in the abundance of benthic and demersal fish species inside wind farms. Trophic dynamics are likely to be altered through changes in predator–prey interactions. This could also lead to negative impacts on some juvenile fishes and invertebrates through increased predation through the aggregation of opportunistic feeders and predatory species. Similar effects would be expected from the use of scour protection and concrete mattresses for cable protection at cable crossing locations. SouthCoast Wind anticipates a maximum of 16 cable crossing locations along the Brayton Point ECC potentially requiring up to nine concrete mattresses each. Interarray cable crossings may also require cable protection, however, cable crossing locations along the interarray cable layout have not yet been identified. Colonization of concrete mattresses used for cable protection by epifouling taxa, mobile invertebrates, and benthic fishes has been found to occur in European wind farms. A recent study on artificial hard substrate colonization at the Hywind Scotland Pilot Park floating offshore wind farm (Karlsson et al. 2022) found species of hydroids, sea stars, crab, lobster, flatfish, and ling inhabiting concrete mattresses used for cable protection three years post construction. It is expected that epifaunal colonization, species succession, and reef effects will also occur on concrete mattresses used within the SouthCoast Wind Project area, however, the magnitude of effects may vary by location and season.

Turbulent wakes resulting from the water flow around turbine foundation structures influence local current speed and direction, which may increase vertical mixing (Segtnan and Christakos 2015; Grashorn and Stanev 2016; Carpenter et al. 2016; Cazenave et al. 2016). In strongly stratified locations, enhanced vertical mixing could increase pelagic primary productivity near the structure (Floeter et al. 2017), increasing the algal food source for zooplankton and filter feeders. Species that rely on soft-bottom habitat, such as surfclams and longfin squid, would experience a reduction in favorable conditions but not to the extent that population-level impacts would be expected. The presence of structures also has potential to influence sediment transport dynamics creating seabed scour that is often reported to reach equilibrium depths of about 1.3 times the foundation diameter (COP Appendix F2; SouthCoast Wind 2024). Project-specific modeling estimated scour would be less than this level (COP Appendix F2; SouthCoast Wind 2024). Species, such as surfclams, that reside in soft-bottom habitat may experience altered dynamics, but not to the extent that population-level impacts would be expected. The added structure from offshore wind development is generally considered to have a net neutral or positive effect on the affected environment from the artificial reef effect (English et al. 2017); however, the level of benefit or impact may vary by species and location (ICF 2021).

The recruitment of larval fish and invertebrate species may also be affected by alterations in water movement around offshore wind turbines. Shifts in circulation patterns could potentially affect the availability of food to species higher up the food chain (ICF 2021). A BOEM study on the effects of changes in hydrodynamics on larval distribution and settlement due to offshore wind development (Johnson et al. 2021) found that larval settlement density could be both positively or negatively affected by altered current speed and direction depending on wind farm build-out scenarios in the Massachusetts-Rhode Island offshore wind energy area and larvae-specific characteristics. In general, shifts in larval settlement patterns were evident for all three species modeled (Atlantic sea scallop, silver hake, and summer flounder). Larval sea scallop settlement density was found to increase south of Block Island but decreased south of Martha's Vineyard in response to increased current speeds north of the offshore wind build-out areas. Silver hake larval settlement shifted to the south of Nantucket Shoals and into the Georges Bank area, while summer flounder larval settlement density decreased in Nantucket Sound both due to reduced current speeds within the offshore wind build-out areas. However, observed shifts in larval settlement are not expected to affect fisheries stocks for these species on a regional level (Johnson et al. 2021).

The presence of WTGs is also expected to result in broadscale effects on nutrient availability, primary production, and ecosystem dynamics (Christiansen et al. 2022; Dorrell et al. 2022; van Berkel et al. 2020) through surface wind speed reductions caused by the extraction of wind energy by wind turbines (wind wake) and hydrodynamic alterations in and around the Lease Area. A recent report by the National Academies of Science Engineering and Medicine (NASEM 2024) evaluated the potential of offshore wind farms to alter the hydrodynamic processes and productivity in the Nantucket Shoals region of the North Atlantic. The report determined that potential ecological impacts from offshore wind projects adjacent to Nantucket Shoals are difficult to predict due to the lack of observational studies and the uncertainty of hydrodynamic effects at the turbine, wind farm, and regional scales. The report further concludes that the hydrodynamic impacts on zooplankton productivity and distribution would be difficult to isolate from the significant impacts of climate change or other influences on the Nantucket Shoals regional ecosystem. As described in Section 3.5.5.3, potential impacts on net primary productivity in the North Atlantic from the presence of structures may occur but more research is needed to determine the extent that these impacts are influenced by changes in ocean stratification or other physical mechanisms. Atmospheric and hydrodynamic effects caused by the presence of WTG structures can be both localized and broad scale extending from a few hundred meters (Li et al. 2014; Schultze et al. 2020) to tens of kilometers (Dorrell et al. 2022; Christiansen et al. 2022) from a WTG and is likely to vary depending on season and location. While observations and model scenarios of wind wakes associated with wind energy fields have been generated for wind farms in the North Sea (Schultze et al. 2020; Daewel et al. 2022; Christiansen et al. 2022), there is still uncertainty regarding the applicability of those models to the oceanographic environment of the northeastern U.S. continental shelf (van Berkel et al. 2020; Miles et al. 2021). Furthermore, the cascading effects on trophic ecology and spatial distribution of fish and invertebrate species in the U.S. Atlantic OCS from wind turbine-induced changes in local and regional ocean dynamics are not yet fully understood and requires further study. Given the current body of knowledge, impacts on finfish, invertebrates, and EFH from wind farm-induced hydrodynamic changes are expected to be permanent and minor but may vary seasonally and regionally.

Traffic (vessel strikes): Project-related vessels used in pre-construction, construction, O&M, and decommissioning may pose a potential collision risk to finfish. Impacts would be greatest during construction, which would require a daily average of 15 to 35 vessels operating with the Offshore Project area or transiting to and from ports, with an expected maximum peak of 50 vessels in the Lease Area at one time, depending on activities. Impacts would be reduced during O&M because fewer vessel trips would be required and increase again during decommissioning. SouthCoast Wind has proposed a range of mitigation measures to avoid or reduce vessel strike risk for marine mammals and sea turtles such as dedicated observers/PSOs, vessel separation requirements, and vessel speed reductions, which may also benefit finfish species.

As described in Section 3.5.5.3, impacts of vessel collisions can result in injury and mortality but no population-level effects would be anticipated. In comparison to existing vessel traffic in the geographic analysis area, the Proposed Action would not have a measurable increase in potential vessel strikes and impacts on finfish, invertebrates, and EFH would be negligible.

Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned non-offshore wind and offshore wind activities. Ongoing and planned non-offshore wind activities that would contribute to impacts on finfish, invertebrates, and EFH include submarine cables and pipelines, tidal energy projects, marine minerals extraction, dredging, military use, marine transportation, fisheries use and management, global climate change, and oil and gas activities.

Cumulative impacts of the Proposed Action would result in negligible to moderate impacts on finfish, invertebrates, and EFH from noise, cable emplacement, accidental releases, anchoring, discharges, EMF, and lighting. Most of the risk of accidental releases of invasive species comes from ongoing activities, and the impacts (mortality, decreased fitness, disease) due to other types of accidental releases are expected to be negligible. Ongoing and planned activities, including the Proposed Action, could collectively affect up to 3,072 acres (12.4 km^2) of seabed from anchoring, of which the Proposed Action would contribute 442 acres (1.78 km^2) or 14 percent. Cumulative impacts from anchoring would likely be minor and short term, with localized impacts only occurring in the immediate vicinity of anchors. The Proposed Action's contribution to impacts from discharge are anticipated to be minimal considering that the Project would contribute only 149 of the 3,094 future offshore wind structures (5 percent). Impacts from other offshore wind projects from EMF and lighting would result in similar impacts as the Proposed Action and result in overall negligible to minor impacts.

Impacts (disturbance, displacement, injury, and mortality) of new cable emplacement and maintenance under the Proposed Action and other offshore wind projects are estimated to affect up to 185,710 acres (751.5 km^2) on the Atlantic OCS. Of this, the Proposed Action would contribute 2,480 acres (10.6 km^2) of seafloor disturbance within the export cable route corridors and 1,408 acres (5.7 km^2) of seafloor disturbance in the Lease Area. In locations experiencing construction, the affected areas are expected to show some natural recovery. Seabed scars associated with jet plow cable installation are expected to recover in a matter of weeks, allowing for recolonization (MMS 2009). Mechanical trenching, which could be used in coarser sediments, could result in more-intense disturbances and a greater width of the impact corridor. Overall, cable placement activities are expected to cause permanent habitat conversion, leading to long-term localized impacts.

Construction and O&M of 3,094 offshore wind structures, including the Proposed Action, would contribute to impacts on finfish, invertebrates, and EFH from the presence of structures and noise. The Proposed Action's contribution to these impacts from installation of 149 structures would be relatively minimal. The cumulative impacts from the presence of structures would likely be minor to moderate, potentially beneficial, and long term, given that hard-structure surfaces could provide benefits to finfish and invertebrates while they are in place. Impacts of the Proposed Action from noise and the presence of offshore wind structures are expected to be long term, over the course of up to 10 years of construction, and negligible to moderate.

Impacts of Alternative B – Proposed Action on ESA-Listed Species

Impacts of the Proposed Action on ESA-listed finfish and invertebrates are limited to impacts on shortnose sturgeon and Atlantic sturgeon due to their occurrence in the Project area. Other ESA species in the geographic analysis area, including the giant manta ray, oceanic whitetip shark, and Atlantic salmon, are not expected to be present in the Offshore Project area. While these species may occur along Proposed Action vessel routes to and from ports, interactions between vessels and species are considered unlikely or are not identified as a threat to the species, as described in Section 3.5.5.1.

The Proposed Action would have similar impacts on Atlantic sturgeon as other non-ESA species. Presence of structures, emplacement and maintenance of cables, EMFs, gear utilization, and traffic are the primary IPFs that may affect migrating Atlantic sturgeon. To a lesser extent, shortnose sturgeon may be affected by nearshore cable emplacement and maintenance, EMFs, and traffic. Shortnose sturgeon may occur in the nearshore ECCs and landfall locations but are not expected in the Lease Area and, thus, would avoid offshore-related impacts from WTG installation.

Atlantic sturgeon would rarely occur in the Lease Area (Stein et al. 2004; Eyler et al. 2009; Dunton et al. 2010; Erickson et al. 2011) and are unlikely to be affected by WTG installation activity. Atlantic sturgeon individuals would only likely be present intermittently, moving through the Lease Area throughout their spring and fall migrations, and may forage opportunistically where benthic prey are present. The Project area is not known to be a preferred foraging area and has not been identified as an aggregation area, which reduces the potential for impact on this species from pile-driving noise. Atlantic sturgeon could be exposed to noises above behavioral thresholds and may avoid the area; however, access to preferred foraging, spawning, or overwintering areas would not be affected, and only cessation of opportunistic foraging during the migration period is expected. Should an exposure occur, it would be temporary with effects dissipating once the activity has ceased or the individual has left the area. Any behavioral effects would be temporary and limited to the small ensonified area with sound levels above the behavioral threshold. Given the dispersed distribution of Atlantic sturgeon in the Lease Area, the extremely unlikely potential for co-occurrence in time and space within the small area where exposure to peak noise could occur, and the anticipated avoidance of disturbing levels of sound, effects of exposure to sound levels above injury or behavioral thresholds is not expected. The greatest concern for Atlantic sturgeon with respect to placement of structures would be the changes in oceanographic and hydrologic conditions resulting from structures in the open ocean and the subsequent impacts on prey sources. However, Atlantic sturgeon consume prey, such as the sand lance, mollusks, polychaete worms, amphipods, isopods, and shrimp, not as closely affected by physical oceanographic features as other ESA-listed species. Potential impacts on larval dispersion and survival of Atlantic sturgeon prey species from changes in hydrologic conditions are unlikely and impacts are expected to be negligible.

Adverse impacts on sturgeon resulting from trawling capture are related to tow speed and duration (Moser et al. 2000). Northeast Fisheries Observer Program data from Miller and Shepherd (2011) indicate that mortality rates of Atlantic sturgeon caught in otter trawl gear is approximately 5 percent. Short-tow durations and careful handling of individuals once on deck are likely to result in a very low risk of mortality to captured individuals. The methods for the proposed trawl survey would employ a tow speed of 3.0 knots and a tow duration of 20 minutes (SMAST 2024), greatly reducing the likelihood of Atlantic sturgeon being caught during survey activities. Individual Atlantic sturgeon have been incidentally captured and released with minor injuries during trawl-based monitoring surveys conducted for the South Fork Wind Project (in BOEM 2023). While the dispersed nature of Atlantic sturgeon, the limited number of trawl tows, and expected short tow duration of fisheries and habitat surveys are not expected to result in Atlantic sturgeon mortality, trawl surveys could still result in the capture of some Atlantic sturgeon along with potential minor injuries associated with the action.

Both Atlantic sturgeon and shortnose sturgeon could be affected by Project vessel traffic to and from ports, with Atlantic sturgeon having the greatest potential for impact. While sturgeon are known to be struck and killed by vessels in rivers and estuaries, there are no reports of vessel strikes in the marine environment, likely due to the space between bottom-oriented sturgeon and the propellers and hulls of vessels (BOEM 2021). Dunton et al. (2010) reported approximately 95 percent of all Atlantic sturgeon captured in a sampling off New Jersey occurred in depths less than 66 feet (20 meters) with the highest catch per unit of effort at depths of 33 to 49 feet (10 to 15 meters). At these depths in open coastal and marine environments, Atlantic sturgeon are not likely to be struck by Project-related vessels. The dispersed nature of vessel traffic and individual sturgeons reduces the potential for co-occurrence of individual sturgeon and individual vessels throughout most of the Project area.

Atlantic sturgeon strikes are most likely to occur in areas with abundant boat traffic such as large ports or areas with relatively narrow waterways (ASSRT 2007). The majority of vessel-related Atlantic sturgeon mortality is likely caused by large transoceanic vessels travelling upriver in river areas that are comparatively narrower and shallower than the waters near the mouth of the river and over habitat types preferred by adult Atlantic sturgeon. In these areas, the draft and propeller depth of ocean vessels may overlap with the depth preference of Atlantic sturgeon (Brown and Murphy 2010; Balazik et al. 2012). In offshore areas, the risk of a vessel strike is likely to be minimal due to overall lower densities of sturgeon and available space for sturgeon to avoid vessels in these areas. Therefore, the potential for vessel strikes to ESA-listed Atlantic sturgeon is considered extremely unlikely to occur. Vessel traffic in relation to the Project is not expected to have a measurable impact on the listed sturgeon species in comparison to existing vessel traffic.

BOEM is in the process of assessing the impacts of the Proposed Action on ESA-listed finfish in the BA and on EFH in the EFH Assessment. BOEM will continue to consult with NMFS under the ESA and results of consultation will be included in the Final EIS. In addition, impacts on EFH will be described in the Final EFH Assessment.

Conclusions

Impacts of the Proposed Action: Activities associated with construction and installation, O&M, and decommissioning of the Proposed Action would have **moderate adverse** and **minor beneficial** impacts on finfish, with the primary impacts on finfish occurring as a result of noise during construction of the Proposed Action. The majority of impacts would likely be behavioral and temporarily displace some finfish, with mortality being a relatively uncommon event as a result of the Proposed Action.

Activities associated with construction and installation, O&M, and decommissioning of the Proposed Action would have long-term but localized and negligible to moderate impacts on EFH, through temporary to permanent but localized disturbance and habitat conversion. Primary impacts on EFH would result from new cable emplacement, the presence of structures, and anchoring. The resources would likely recover naturally over time. Soft-bottom habitat and sand ripples are expected to recover quickly. Sedimentation due to development activities would only affect habitat in the short term before dissipating. The presence of structures is expected to lead to aggregations and the formation of artificial reefs, creating new habitat with beneficial impacts.

Activities associated with construction and installation, O&M, and decommissioning of the Proposed Action alone would have negligible to moderate impacts on invertebrates through temporary disturbance and displacement, habitat conversion, and behavioral changes, injury, and mortality of sedentary fauna. The presence of structures may have a minor beneficial effect on invertebrates through an artificial reef effect. Despite invertebrate mortality and varying extents of habitat alteration, BOEM expects the long-term impact on invertebrates from construction and installation of the Proposed Action to be moderate. Although some resources would likely recover naturally over time, the proposed activities are likely to create areas of permanent habitat conversion. In general, the impacts are likely to be local and thus would not be expected to extend to the far-larger geographic analysis area (i.e., LME). The larger invertebrate geographic analysis area was selected to account for migratory movement of mobile species that are predicted to experience negligible impacts with respect to the Proposed Action's contribution to the impacts of individual IPFs resulting from ongoing and planned activities. The primary impacts on invertebrates would be expected to occur as a result of new cable emplacement, the presence of structures, noise from pile driving, and anchoring.

Cumulative Impacts of the Proposed Action: Cumulative impacts from the Proposed Action when combined with the impacts from ongoing and planned activities, including offshore wind activities, would result in **moderate adverse** impacts on finfish, invertebrates, and EFH in the geographic analysis area.

3.5.5.6 Impacts of Alternative C on Finfish, Invertebrates, and Essential Fish Habitat

Impacts of Alternative C: Alternatives C-1 and C-2 would avoid EFH and HAPCs by avoiding cable installation in the Sakonnet River through alternative onshore routes. Alternative C-1 would reduce the total offshore export cable route by 9 miles (14 kilometers) and Alternative C-2 would reduce the total offshore export cable route by 12 miles (19 kilometers). These reductions in offshore export cable length would eliminate the construction and installation impacts from cable emplacement and anchoring in the Sakonnet River compared to the Proposed Action. The sensitivity of the Alternative C local environment relative to the environment where the cable would be located under the Proposed Action could influence the magnitude of the potential reduction in impacts from Alternative C-1 and Alternative C-2. The Sakonnet River contains a mix of soft-bottom and complex substrates, which can be important benthic habitats for fish and invertebrates (refer to the analysis of Alternative C in Section 3.5.2, *Benthic Resources* for a description of benthic habitat impacts along the Brayton Point ECC). In a few locations, live *Crepidula* reefs or *Crepidula* shell hash were found on the sediment surface overlying reduced silt

(COP Appendix M.2; SouthCoast Wind 2024), which is a biogenic habitat that also adds complexity to the seafloor. This complex habitat, along with some boulder fields in Mount Hope Bay, are EFH for many species, and Alternative C will avoid the disturbance of this benthic habitat. Because the Sakonnet River is HAPC for juvenile Atlantic cod, there is a greater potential for Alternative C to avoid or minimize impacts on this species than the Proposed Action because cable emplacement would not occur in the Sakonnet River. Impacts on shortnose sturgeon that make coastal migrations through the nearshore estuarine waters of the Sakonnet River may also be reduced because there would be a decrease in estuarine benthic disturbance under both Alternatives C-1 and C-2, although their presence in this area is considered unlikely.

Project-specific site-assessment surveys are not available for the portion of the Alternative C export cable corridors that diverge from the Proposed Action cable corridors. However, to support BOEM's analysis of the alternatives, SouthCoast Wind commissioned a geohazard desktop study that evaluated geological features and other constraints associated with both Alternatives C-1 and C-2 (TetraTech 2023) and a desktop benthic study using available site-specific and regional benthic data for Alternative C-1 (INSPIRE 2023b). Within the 6-mile portion of the Alternative C-1 route toward the Aquidneck Island landfall, all of the over 20 USGS benthic grab samples consisted of Muddy Sand and Sand, except for one Gravel sample near the landfall location at Sachuest Beach (INSPIRE 2023b). However, the Alternative C-1 route would pass through Elbow Ledge, a high relief bathymetric feature to the south of Sachuest Bay that attracts fish from surrounding areas (Section 3.5.2, *Benthic Resources*, Figure 3.5.2-2). This shoal likely provides hard substrate for attached fauna to grow and complex habitat that supports benthic and demersal species (INSPIRE 2023b). By passing through Elbow Ledge, Alternative C-1 could present more challenges during cable installation and may potentially create a greater impact to EFH compared to the similar offshore portion of the Proposed Action cable route.

As under the Proposed Action, SouthCoast Wind would use HDD for the installation of the Alternative C offshore export cables beneath the shallower nearshore areas at all landfall locations. This is expected to substantially reduce impacts of sediment dispersion on sensitive habitats, such as SAV and wetlands, which could serve as EFH. Based on the moderate and temporary to short term nature of impacts from cable emplacement for the Proposed Action, BOEM anticipates that potential effects from avoiding the installation of export cables in the Sakonnet River would result in a reduced impact on finfish, invertebrates, and EFH but would not change the overall impact level.

The reductions in offshore export cable length would likewise reduce the O&M impacts associated with the long-term presence of cable protection compared to the Proposed Action. The potential difference in impacts between the Proposed Action and Alternative C from the presence of structures would depend on the amount of cable protection required and the habitat type where it is placed. In comparison to the Proposed Action, the amount of cable protection is anticipated to be less for Alternative C-1 followed by Alternative C-2 based on cable length. Anticipated impacts associated with finfish, invertebrates, and EFH during operation of cables under the Proposed Action are expected to be minor, potentially beneficial, and long term, given that hard-structure surfaces could provide benefits to finfish and invertebrates while they are in place. Due to the potentially adverse and beneficial long-term impacts of the presence of structures, BOEM anticipates that potential benefits from avoidance of cable emplacement impacts within Sakonnet River habitats would not result in a change in impact level from O&M on finfish, invertebrates, and EFH.

Cumulative Impacts of Alternative C: In the context of reasonably foreseeable environmental trends, cumulative impacts of Alternative C would be similar to those described under the Proposed Action.

Impacts of Alternative C on ESA-Listed Species

The export cable reroute under Alternatives C-1 and Alternative C-2 would not cross other habitats important to ESA-Listed species, but it would have a reduced total length of offshore export cable installation and, therefore, reduced potential impacts from construction, installation, operations, and maintenance. Under the Proposed Action, new cable emplacement and maintenance are expected to have negligible impacts on ESA-listed species. Therefore, BOEM anticipates that impacts on ESA-listed species under Alternative C would not be measurably different from those anticipated under the Proposed Action.

Conclusions

Impacts of Alternative C: Alternative C would reduce cable-related impacts on finfish, invertebrates, and EFH within the Sakonnet River compared to the Proposed Action. The Sakonnet River is an important area for juvenile Atlantic cod and other species with EFH present, but overall impacts on this area under the Proposed Action area are anticipated to be small and make up a small portion of the overall Project impacts. Therefore, construction and installation, O&M, and decommissioning of Alternative C would likewise result in **moderate** adverse impacts on finfish, invertebrates, and EFH from cable emplacement and **minor** adverse impacts from cable maintenance and anchoring, and these activities could include **minor beneficial** impacts from the reef effect associated with the presence of structures. For all other IPFs specific to Alternative C, impacts are expected to be negligible.

Cumulative Impacts of Alternative C: In context of reasonably foreseeable environmental trends, BOEM anticipates that the cumulative impacts associated with Alternative C would be similar to the Proposed Action and result in **moderate adverse** impacts on finfish, invertebrates, and EFH.

3.5.5.7 Impacts of Alternative D (Preferred Alternative) on Finfish, Invertebrates, and Essential Fish Habitat

Impacts of Alternative D: Alternative D would eliminate six WTGs in the northeastern portion of the Lease Area to reduce potential impacts on foraging habitat and potential displacement of wildlife from this habitat adjacent to Nantucket Shoals (Chapter 2, Figure 2-7). The northeastern edge of the Lease Area is about 3.1 miles (5 kilometers) from the 30-meter isobath boundary of Nantucket Shoals. Nantucket Shoals provides important habitat for fish species and removing WTGs near this area may reduce impacts on finfish, invertebrates, and EFH. Notably, the northeastern portion of the Lease Area is approximately 20 miles (32 kilometers) from the Great South Channel Habitat Management Area (GSC HMA) in Nantucket Shoals, which the New England Fishery Management Council (NEFMC) established to protect complex benthic habitats important to juvenile cod and other groundfish species from mobile bottom-tending fishing gear (NOAA 2020). The species with EFH designations in the GSC HMA, and by extension Nantucket Shoals, are the same species that have EFH designations within the Lease Area for all life stages, including Atlantic cod, Atlantic sea scallop, windowpane flounder, winter flounder, yellowtail flounder, and longfin inshore squid (NEFMC 2018; Guida et al. 2017). Excluding Atlantic Sea scallop, these species are designated as overfished as a result of overfishing, habitat degradation, pollution, climate change, and disease (NOAA 2021). Eliminating WTGs would reduce impacts on these species associated with the construction and O&M of the Project.

The greatest source of impacts generated by WTG installation on fish is noise pollution from pile driving. As discussed in Section 3.5.5.5, *Impacts of Alternative B,* injury from prolonged cumulative exposure (over the entire installation of a pile) would extend as far as 10 miles (16.65 kilometers) (

Table). Because the northeastern edge of the Lease Area is located within 3.1 miles (5 kilometers) of the 30-meter isobath of Nantucket Shoals, removal of six WTGs at the edge of the Lease Area would lessen, but not avoid, noise exposure on EFH in Nantucket Shoals, as noise impacts from pile driving activity from other WTGs would still extend beyond the 30-meter isobath.

Other impacts from WTG installation, such as sediment dispersion from installation activities, would be reduced locally near the site of the WTGs, but these impacts would likely not extend into Nantucket Shoals regardless of Alternative D. The removal of six WTGs would also likely not result in a meaningful change in impacts associated with the presence of structures on hydrodynamic and atmospheric effects, because these effects may extend for several tens of kilometers beyond a wind farm (Christiansen et al. 2022). Other effects, whether adverse, beneficial, or neutral would likely not be greatly affected by the elimination of six WTGs as impacts from construction and O&M of 143 WTG/OSP foundations would still occur. Overall, BOEM anticipates that Alternative D would reduce impacts on finfish, invertebrates, and EFH by increasing the distance from the boundary of construction activities to the boundary of Nantucket Shoals but the overall impact magnitudes would be the same as the Proposed Action.

Cumulative Impacts of Alternative D: In the context of reasonably foreseeable environmental trends, cumulative impacts of Alternative D would be similar to those described under the Proposed Action.

Impacts of Alternative D on ESA-Listed Species

Impacts on ESA-listed species associated with Alternative D would be largely similar to the impacts associated with the Proposed Action.

Conclusions

Impacts of Alternative D: Alternative D would reduce impacts on finfish, invertebrates, and EFH compared to the Proposed Action by eliminating six WTGs nearest to Nantucket Shoals, which provides important fish habitat and EFH for several fish species. While impacts would be reduced locally near the sites of the six removed WTG positions, impacts from the remaining 143 WTG/OSP foundations would still occur. Therefore, Alternative D is not expected to change the overall impact magnitude of the Project compared to the Proposed Action. Construction and installation, O&M, and decommissioning of Alternative D would likewise result in **moderate adverse** impacts on finfish, invertebrates, and EFH from interarray cable emplacement and **minor adverse** impacts from cable maintenance, anchoring, pile driving noise, and foundation installation, and could include **minor beneficial** impacts from the reef effect associated with the presence of structures. For all other IPFs specific to Alternative D, impacts are expected to be negligible.

Cumulative Impacts of Alternative D: In context of reasonably foreseeable environmental trends, BOEM anticipates that the cumulative impacts associated with Alternative D would be similar to the Proposed Action and result in **moderate adverse** impacts on finfish, invertebrates, and EFH.

3.5.5.8 Impacts of Alternative E on Finfish, Invertebrates, and Essential Fish Habitat

Impacts of Alternative E: Alternative E includes the use of all piled (Alternative E-1), all suction-bucket jacket (Alternative E-2), or all GBS (Alternative E-3) foundations for WTGs and OSPs. Because the Proposed Action already considers maximum pile-driving impacts of all 149 structures, there would be no difference in impacts from Alternative E-1. Alternative E-1 would install the WTGs and OSPs on either monopile or piled jacket foundations. These foundations would require installation via pile-driving. All noise-related impacts, including acoustic stress and alterations of movement, calling, and spawning behavior in finfish and invertebrates described under the Proposed Action are applicable under Alternative E-1. Impact pile driving for piled jacket foundations would occur for 2 hours per foundation with a maximum of eight piles installed per day. Impact pile driving for monopiles would occur for 4 hours per foundation with a maximum of two piles installed per day. Under Alternative E-2 and Alternative E-3, no impact pile driving would be conducted, eliminating impacts due to underwater noise. Absent the potential impacts on finfish and invertebrates from pile-driving noise, the overall construction and installation impacts on finfish and invertebrates would be reduced under Alternative E-2 and Alternative E-3 compared to the Proposed Action.

GBS foundations, under Alternative E-3, would result in the greatest area of benthic habitat disturbance from the foundation footprint and scour protection at an additional 1,317 acres compared to the Proposed Action (Table 3.5.5-12). Alternative E-2, all suction-bucket jacket foundations, would increase the benthic disturbance area by 336 acres while Alternative E-1, all piled foundations, would be expected to have the same benthic disturbance area as the Proposed Action (Table 3.5.5-12). A smaller foundation footprint would reduce O&M impacts due to the presence of structures and less scour protection would result in a decrease in soft-bottom habitat disturbance. This would benefit the existing soft-bottom benthic, surficial, and infaunal fish and invertebrate communities within the Lease Area.

Table 3.5.5-12. Acreage of benthic disturbance from Alternative E compared to the Proposed Action

Alternative	Difference in Area of Benthic Disturbance from Proposed Action
Alternative E-1: All Piled Foundation Structures	Same as Proposed Action
Alternative E-2: Suction-bucket Jacket Foundations only	336 acres more
Alternative E-3: Gravity-based Foundations only	1,317 acres more

All foundations would require some seabed preparation before construction. Seabed preparation may be required especially if the seabed is not sufficiently level. For Alternative E-1 piled foundations, in addition to permanent foundation and scour protection, there would be an additional 0.5 acre of temporary seabed disturbance per foundation. Alternative E-2 suction bucket jacket foundations require an additional 0.6 acre of temporary seabed disturbance per foundation. Alternative E-3 GBS foundations may include rock layer/scour protection and dredging. In addition to permanent foundation and scour protection, an additional 1.0 acre of temporary seabed disturbance per WTG foundation and 1.5 acre per OSP foundation would be required for Alternative E-3.

Alternative E-3 would result in the greatest artificial reef creation, due to the GBS foundations having the largest footprint. As discussed under the Proposed Action, the artificial reef effect from scour protection may increase overall abundance and diversity of finfish and invertebrates. Alternative E-2 and the piled jacket foundations of Alternative E-1 would provide more surface area for aggregation, while monopiles would provide the least. The increased surface area would also increase the potential of invasive species impacts. With more area to colonize, Alternative E-3 would have the largest risk of harboring invasive species.

Given that Alternative E would result in reductions in both adverse and beneficial impacts, O&M impacts on finfish, invertebrates, and EFH are not expected to be measurably different from those anticipated under the Proposed Action.

Cumulative Impacts of Alternative E: In the context of reasonably foreseeable environmental trends, cumulative impacts of Alternative E would be similar to those described under the Proposed Action.

Impacts of Alternative E on ESA-Listed Species

Activities would not differ between the Proposed Action and Alternative E-1. Under Alternative E-2 and Alternative E-3, no impact pile driving would be conducted, eliminating impacts due to underwater noise on ESA-listed species compared to the Proposed Action. However, with the larger areas of habitat conversion associated with foundation types used in Alternative E-2 and Alternative E-3, more soft-bottom habitats would be rendered unavailable to EFH species including ESA-listed species that forage in these habitats (e.g., Atlantic sturgeon). Other impacts of Alternative E on ESA-listed species would be similar to the impacts of the Proposed Action.

Conclusions

Impacts of Alternative E: Impacts of Alternative E-1 would not be measurably different than the impacts of the Proposed Action. Therefore, construction, O&M, and decommissioning of Alternative E-1 would result in **moderate** adverse impacts on finfish, invertebrates, and EFH from interarray cable emplacement and **minor** adverse impacts from cable maintenance, anchoring, pile driving noise, and foundation installation, and could include **minor beneficial** impacts from the reef effect associated with the presence of structures. For all other IPFs specific to Alternative E-1, impacts are expected to be negligible.

Impacts of Alternative E-2 and Alternative E-3 would be similar to impacts of the Proposed Action with the most notable difference the reduction in short-term impacts from avoidance of pile-driving noise and the increase in long-term impacts from larger foundation footprints. Construction, O&M, and decommissioning of Alternative E-2 and Alternative E-3 would still result in **moderate adverse** impacts on finfish, invertebrates, and EFH from interarray cable emplacement and **minor adverse** impacts from cable maintenance, anchoring, and foundation installation, and could include **minor beneficial** impacts from the reef effect associated with the presence of structures. For all other IPFs specific to Alternatives E-2 and E-3, impacts are expected to be negligible.

Cumulative Impacts of Alternative E: In context of reasonably foreseeable environmental trends, BOEM anticipates that the cumulative impacts of Alternative E would be similar to the Proposed Action and result in **moderate adverse** impacts on finfish and invertebrates.

3.5.5.9 Impacts of Alternative F on Finfish, Invertebrates, and Essential Fish Habitat

Impacts of Alternative F: Under Alternative F, the Falmouth offshore export cable route would include the use of up to three ±525kV HVDC cables connected to one HVDC converter OSP (if Falmouth is selected as the POI for Project 2), instead of up to five HVAC cables connected to one or more HVAC OSPs as proposed under the Proposed Action. The addition of an HVDC converter OSP would result in the same types of impacts as described under the Proposed Action, including entrainment of fish larvae at cooling water intakes and thermal plume discharge, but impacts could be greater because there would be one additional HVDC converter OSP under Alternative F (the Proposed Action includes at least one HVDC converter OSP but also includes the potential for multiple). The HVDC converter OSP associated with Falmouth for Project 2 would be in the southern portion of the Lease Area. The design of the OSP is expected to be the same as the OSP for Project 1 for Brayton Point, which is described in greater detail under the analysis of the Proposed Action based on the NPDES permit application (TetraTech and Normandeau Associates, Inc. 2023) and would, therefore, result in the same entrainment/impingement impacts, except that the OSP would be located in deeper water and at a further distance from Nantucket Shoals.

In modeling the effects of entrainment on larval dispersal patterns and population dynamics associated with once-through CWISs in power plants in the coastal region of California, White et al. (2010) found that the effects of CWIS entrainment were highly localized in space and had minimal effects on population densities except when the population had been heavily depleted by other factors. Entrainment effects were also found to be more severe when the CWIS intake was located nearshore as opposed to farther offshore due to the low rates of diffusive movement nearshore. Eggs and larvae of overfished species with poor stock status (e.g., Atlantic cod, Atlantic herring, red hake) that spawn within the vicinity of the SouthCoast Wind converter station OSPs would be vulnerable to entrainment effects. However, applicant-committed mitigation measures in the operation of the converter OSP CWIS, such as restricting intake velocities to less than 0.5 foot per second (0.15 meter per second), single pump operation, and dual pump operation at reduced capacity via three-way valve or variable frequency drives have been put in place to minimize potential entrainment and impingement impacts (TetraTech and Normandeau Associates, Inc. 2023). With these measures in place, impacts would be minimized, and it is not expected that Alternative F would result in a substantive increase in adverse impacts from an additional HVDC converter OSP compared to the Proposed Action (the Proposed Action includes the potential for multiple HVDC converter OSPs).

The reduction in the number of cables from five HVAC cables to three HVDC cables would reduce the total seabed disturbance and benthic habitat disturbance in the Falmouth ECC by approximately 700 acres (2.8 square kilometers). While the exact location of the up to two cables that would not be installed under Alternative F is not yet known, within the Muskeget channel the reduction in cable disturbance is expected to minimize impacts on complex benthic habitats in this area. Approximately

2,140 acres of complex habitat (coarse sediment, glacial moraine A, and boulder fields) can be found within an 8.2-mile (13.2-kilometer) segment of the Falmouth ECC as it crosses the Muskeget Channel (Table 3.5.5-3; INSPIRE 2022). The total width of disturbance of the cables would be reduced from 98.5 feet (assuming a 19.7-foot-wide disturbance per cable; COP Volume 1, Table 3-29; SouthCoast Wind 2024) under the Proposed Action to 59.1 feet (18 meters) under Alternative F, reducing the extent of impacts on habitats along this segment of the Falmouth cable corridor from 98 acres to 59 acres. Depending on the final cable placement within the ECC, up to a 40 percent reduction in seabed disturbance from installation of the Falmouth offshore export cables can be anticipated, which would reduce impacts on benthic habitats, in particular complex habitats found in the Muskeget Channel, that may be important EFH. Other impacts from cable emplacement activities including temporary entrainment/impingement effects during cable-laying operations and anchoring may also be reduced under Alternative F due to fewer cables installed compared to the Proposed Action.

Though fewer DC cables would be installed under Alternative F, the amplitude of EMFs generated by DC cables can be up to three times greater than that of AC cables (Hutchison et al. 2020b). However, AC and DC EMFs differ in the way they interact with organisms and direct comparisons cannot be made (CSA Ocean Sciences, Inc. and Exponent 2019). Previous studies on DC undersea cables have shown only temporary alterations in mobility and behavior of some fish and invertebrate species with no appreciable effects on overall movement or population health (Hutchison et al. 2018; Wyman et al. 2018; Klimley et al. 2017). Furthermore, the effects of EMF from undersea cables are substantially reduced when the target cable burial depth of 3.2 to 13.1 feet (1.0 to 4.0 meters) is achieved (CSA Ocean Sciences, Inc. and Exponent 2019). Even with the reduction in cables, the same temporary construction impacts and long-term operational impacts from cable installation would still occur and there would be no change in impacts from other offshore components (e.g., WTGs). Therefore, the overall impact magnitude would be the same as the Proposed Action.

Cumulative Impacts of Alternative F: In the context of reasonably foreseeable environmental trends, cumulative impacts of Alternative F would be similar to those described under the Proposed Action.

Impacts of Alternative F on ESA-Listed Species

Alternative F would reduce the area of benthic habitat disturbance in the Falmouth ECC by an estimated 700 acres (2.8 square kilometers) due to fewer cables being installed compared to the Proposed Action. ESA-listed species that use these habitats would also experience reduced impacts from cable emplacement activities. The addition of a second HVDC converter OSP would increase the potential entrainment impact on the prey of ESA-listed species that occur within the vicinity of the converter OSP though mitigation measures in the operation of the CWIS may minimize these impacts.

Conclusions

Impacts of Alternative F: Impacts of Alternative F would not be measurably different from the impacts of the Proposed Action. Therefore, construction and installation, O&M, and decommissioning of Alternative F would likewise result in **moderate adverse** impacts on finfish, invertebrates, and EFH from cable emplacement and HVDC OSP entrainment, **minor adverse** impacts from cable maintenance, anchoring, EMFs, and HVDC OSP thermal effluent, and could include **minor beneficial** impacts from the reef effect associated with the presence of structures. For all other IPFs specific to Alternative F, impacts are expected to be negligible.

Cumulative Impacts of Alternative F: In context of reasonably foreseeable environmental trends, BOEM anticipates that the cumulative impacts of Alternative F would be similar to the Proposed Action and result in **moderate adverse** impacts on finfish, invertebrates, and EFH.

3.5.5.10 Comparison of Alternatives

The impacts resulting from many of the individual IPFs associated with construction, O&M, and conceptual decommissioning of the Project under all action alternatives would be similar to those described under the Proposed Action. The IPFs can be grouped under general evaluation of those with the potential to cause sedimentation and habitat alteration (e.g., cable emplacement, structures, anchoring); those that would generate noise (e.g., pile driving, construction noise, trenching, vessels); accidental releases (e.g., spills, debris, invasive species); EMFs; the presence of structures (hydrodynamic disturbance, fish/invertebrate aggregation, migration disturbance); and climate change. The impacts expected to differ most among alternatives are from the presence of structures, cable installation and maintenance, while impacts of most IPFs (i.e., EMFs, lighting, accidental releases, vessel noise and anchoring) are expected to remain similar among the alternatives. These IPFs were considered in the following assessment of Alternatives B, C, D, F, and E on finfish, invertebrates, and EFH.

The number of WTGs would be reduced under Alternative D, while the number of WTGs under Alternatives C, E, and F would be the same as under the Proposed Action. Foundation structures would differ in Alternatives E-1, E-2, and E-3. Alternative E-1 would not differ significantly from the Proposed Action, merely in the decision to use monopile foundations or piled jacket foundations. Impacts from noise under Alternative D would be similar to those described under the Proposed Action; however, the duration of impacts would be shorter due to the reduced number of foundations. Alternatives E-2 and E-3 would also result in decreased noise during construction by avoiding impact pile driving. Under Alternatives E-2 and E-3, the footprint of each foundation would increase in size, thus, increasing the amount of seabed preparation for each foundation resulting in greater impacts during the construction phase from seafloor preparation. This increase in footprint of each foundation would ultimately contribute more hard surface area on-bottom and in the water column for invertebrate colonization and EFH and provide more overall structure for finfish aggregation.

The removal of WTGs in Alternative D would avoid impacts on the northeastern portion of the Lease Area, which abuts the Nantucket Shoals, and would avoid impacts on foraging finfish in the Nantucket Shoals. Alternative D would reduce impacts on any invertebrates and EFH at those foundation locations, given that there would be fewer foundations developed and, therefore, lower noise impact duration associated with pile driving and permanent loss of habitat. Additionally, the removal of six turbines would result in a reduction in the extent of IAC, thus, reducing or avoiding the short-term impacts of turbidity and sedimentation from cable emplacement and maintenance, the long-term impacts of boulder relocation, and the potential cable armoring for those IACs. As mentioned in Section 3.5.5.7, *Impacts of Alternative D on Finfish, Invertebrates, and Essential Fish Habitat*, the reduction of six turbines would likely not have an appreciable impact on hydrodynamic and atmospheric wake effects of the WTGs. Consequently, impacts associated with WTG construction, O&M, and decommissioning would be reduced under Alternative D but not under Alternatives C, F, and E compared to the Proposed Action; although the types of impacts and habitats affected may differ slightly in extent (i.e., differences among Alternatives E-1, E-2, and E-3) compared to the Proposed Action.

Alternatives C and F seek to reduce impacts on the Sakonnet River and the Muskeget Channel respectively by considering land routes (Alternatives C-1 and C-2) and cable reductions (Alternative F). Additionally, Alternative F would increase the number of HVDC converter OSPs from one to two. Under Alternative C, there would be no impacts associated with cable emplacement and maintenance in the Sakonnet River reducing impacts on finfish, invertebrates, and EFH in that location. HVDC conversion would reduce the number of cables going through EFH habitat in the Muskeget Channel, therefore, reducing impacts associated with cable emplacement and maintenance. The addition of two HVDC OSPs under Alternative F would likely not appreciably change the impacts on the benthic environment because the foundation types would be the same as those used for the WTGs, thus, not having appreciable differences for demersal finfish, invertebrates, and EFH at the OSP foundation location. Entrainment and impingement of larvae and release of thermal plumes would be the same as described in Section 3.5.5.5, *Impacts of Alternative B on Finfish, Invertebrates, and Essential Fish Habitat*, but would be essentially doubled with the addition of an HVDC OSP for both the Brayton Point and Falmouth ECCs. The overall noticeable impacts would be similar across Alternatives C and E, although direct impacts on finfish, invertebrates, and EFH would be slightly reduced under Alternatives C and E in the ECCs by reducing the impact on the benthic environment.

3.5.5.11 Proposed Mitigation Measures

Additional mitigation measures identified by BOEM and cooperating agencies as a condition of state and federal permitting, or through agency-to-agency negotiations, are described in detail in Appendix G, Tables G-2 and G-4 and summarized and assessed in Table 3.5.5-14. If one or more of the measures analyzed below are adopted by BOEM or cooperating agencies, some adverse impacts on finfish, invertebrates, and EFH could be further reduced. After publication of the Draft EIS, BOEM conducted consultation with NMFS pursuant to Section 305(b) of the MSA (i.e., EFH consultation), which resulted in NMFS issuing EFH Conservation Recommendations. EFH Conservation Recommendations are analyzed collectively in Table 3.5.5-13. The Draft EIS analyzed a BOEM-proposed measure for fisheries and benthic habitat monitoring surveys. Fisheries and benthic habitat monitoring survey plans were subsequently developed by the Lessee and are analyzed as part of the Proposed Action in the Final EIS.

Table 3.5.5-13. Mitigation and Monitoring Measures Resulting from Consultation (also identified in Appendix G, Table G-2): finfish, invertebrates, and essential fish habitat

Measure	Description	Effect
EFH Conservation Recommendations	EFH Conservation Recommendations from NMFS were transmitted by letter dated September 23, 2024. EFH Conservation	Implementation of Conservation Recommendations, including micrositing WTGs and cables, scour protection

Measure	Description	Effect
	Recommendations for activities under BOEM's jurisdiction were provided for WTG and cable installation and relocation (micrositing), anchoring, temperate reef avoidance, spill prevention, anti-corrosion measures, habitat alteration minimization, boulder relocation, marine debris removal, scour protection, noise mitigation, contents Implementation of Conservation Recommendations, including micrositing WTGs and cables, scour protection material and avoidance, anchoring avoidance and practices, reduced distance in boulder/cobble relocation, sand bedform removal avoidance, conservation of submarine topography and benthic features, overtrenching and sufficient cable burial depth, cable cross-mapping, and seafloor, EFH Conservation Recommendations for activities under USACE's jurisdiction were provided for inshore/estuarine habitat impact minimization, mitigation of impacts on scientific surveys, temperate reef avoidance and in situ impact monitoring, and provision of locations of relocated boulders, created berms, and scour protection.	material and avoidance, anchoring avoidance and practices, reduced distance in boulder/cobble relocation, sand bedform removal avoidance, conservation of submarine topography and benthic features, overtrenching and sufficient cable burial depth, cable cross-mapping, and seafloor surveying and monitoring would minimize known or reasonably foreseeable adverse impacts on benthic habitats and features, sensitive habitats, sand bedforms, Nantucket shoals, NOAA Complex Category habitats, the Sakonnet River, Mount Hope Bay, Southern New England HAPC, and the Narragansett Bay Estuary minimizing the potential for elimination/conversion of existing benthic habitats. Conservation Recommendations for inshore/estuarine and nearshore areas, including the use of HDD, micrositing, and re-rerouting during cable installation, the avoidance of sidecasting and open-water disposal during trenching activities, the use of a closed clamshell/environmental bucket dredge and upland disposal during dredging activities in areas with elevated levels of contaminants, and the restoration of disturbed areas to preconstruction conditions would minimize impacts on inshore/estuarine and nearshore benthic habitats and species. Conservation Recommendations for noise during construction, such as the use of additional noise dampening/mitigation measures during all impact pile driving, mandatory quiet periods during pile driving of at least 4 hours per 24 hours, and noise mitigation protocols in consultation with resource agencies prior to construction activities, would avoid and minimize potential noise impacts on benthic species and habitat. Conservation Recommendations for spill preventative measures, anti-corrosion measures, and marine debris removal would minimize potential impacts from any marine debris collected during pre-lay grapnel runs and chemicals, contaminant emissions, anti-corrosive coatings and sacrificial anodes to benthic habitats and species. Conservation Recommendations

Measure	Description	Effect
		to revise the Benthic Habitat Monitoring Plan would benefit benthic habitat and species by ensuring robust experimental design, methods, and data collection/analysis to assess changes in benthic communities in the Project area. The Conservation Recommendation to mitigate impacts on NMFS scientific surveys would ensure that NMFS can continue to monitor the status and health of trust resources. The Conservation Recommendations to develop a Project-specific in situ Monitoring Program and to perform pre-, during, and post-construction in situ monitoring of temperate reefs would benefit benthic habitat and species by assessing the stressors created by Project operation on benthic communities in the Project area, and stressors created by Project construction and operation on temperate reefs, from the presence of turbines, construction and operational noise, heat and EMF exposure, and oceanic-wind wake effects, as well as monitor impacts on fish behavior, species occurrence, community composition, and density and abundance on temperate reefs. Conservation Recommendations to provide the locations of relocated boulders, created berms, scour protection, and cables requiring wet storage to relevant marine users would minimize impacts on benthic habitat by reducing the potential of gear obstructions, which would disturb benthic habitat. Although the Conservation Recommendations would provide incremental reductions in impacts on sensitive and complex habitats and temperate reefs, reductions in the overall impact rating are not anticipated for any of the Proposed Action's IPFs.
Draft NMFS Biological Opinion Reasonable and Prudent Measures	The Lessee must comply with measures in the Biological Opinion and conduct sound field verification to ensure distances to thresholds for ESA-listed fish are not exceeded during impact pile driving. SouthCoast must also report any effects to ESA-listed fish or incidental take of these species.	Reasonable and Prudent Measures and Terms and Conditions from the NMFS Biological Opinion would minimize impacts on finfish, invertebrates, and EFH during construction and installation and O&M of the Project. While adoption of this measure would decrease risk to

Measure	Description	Effect
		finfish, invertebrates, and EFH under the Proposed Action, it would not alter impact determinations.

Table 3.5.5-14. BOEM or agency-proposed measures (also identified in Appendix G, Table G-3): finfish, invertebrates, and essential fish habitat

Measure	Description	Effect
HVDC open-loop cooling system avoidance area	To minimize potential impacts on zooplankton from impingement and entrainment in offshore wind HVDC converter station open-loop cooling systems, no open-loop cooling systems would be permitted in the enhanced mitigation area of the Lease Area. No geographic restrictions on the offshore export cable corridor, nor the installation of an HVAC OSP are included in this mitigation measure.	Minimizes entrainment impacts on egg and larval stages of EFH species, NOAA Trust Resources, and prey species. Nantucket Shoals supports dense aggregations of zooplankton such as gammarid shrimp and copepods, which in turn, support higher tropic levels of wildlife. While the SouthCoast Wind Project would not overlap with the highest modeled densities of zooplankton in the Nantucket Shoals region, BOEM is requiring a precautionary measure to reduce the magnitude of potential mortality from entrainment of zooplankton in an HVDC open-loop cooling system. This measure is anticipated to result in less mortality to prey species for higher trophic level fish than compared with project design envelope which could include HVDC OSP locations closer to Nantucket Shoals and thus closer to higher densities of zooplankton.
Pile-driving time of Year restriction in enhanced mitigation area	Pile driving within the enhanced mitigation area would occur only between June 1 to October 31 when NARW presence is at its lowest. This time frame also falls outside of the spawning season of fish species in Nantucket Shoals such as Atlantic cod (fall to winter) (Weiss et al. 2005).	While this mitigation measure was proposed to ensure that no NARW are exposed to injurious levels of noise from pile driving, it also protects EFH species and NOAA Trust Resources that occur in the area during winter and spring, including spawning Atlantic cod.
Sand Wave Leveling and Boulder Clearance	Sand wave leveling and boulder clearance should be limited to the extent practicable. Best efforts should be made to microsite to avoid these areas.	Minimizes direct habitat impacts on EFH, EFH species, and NOAA Trust Resources associated with sand wave and boulder habitats.

Measures Incorporated in the Preferred Alternative

Mitigation measures required through completed consultations, authorizations, and permits listed in Table 3.5.5-13 and Tables G-2 through G-4 in Appendix G are incorporated into the Preferred Alternative. If adopted, these measures would have the effect of reducing the potential for injurious sound levels during the pile-driving construction period. While the impact determination for finfish, invertebrates, and EFH described in Section 3.5.2.5 would not change, these measures would ensure the effectiveness of, and compliance with, environmental protection measures already analyzed as part of the Proposed Action.

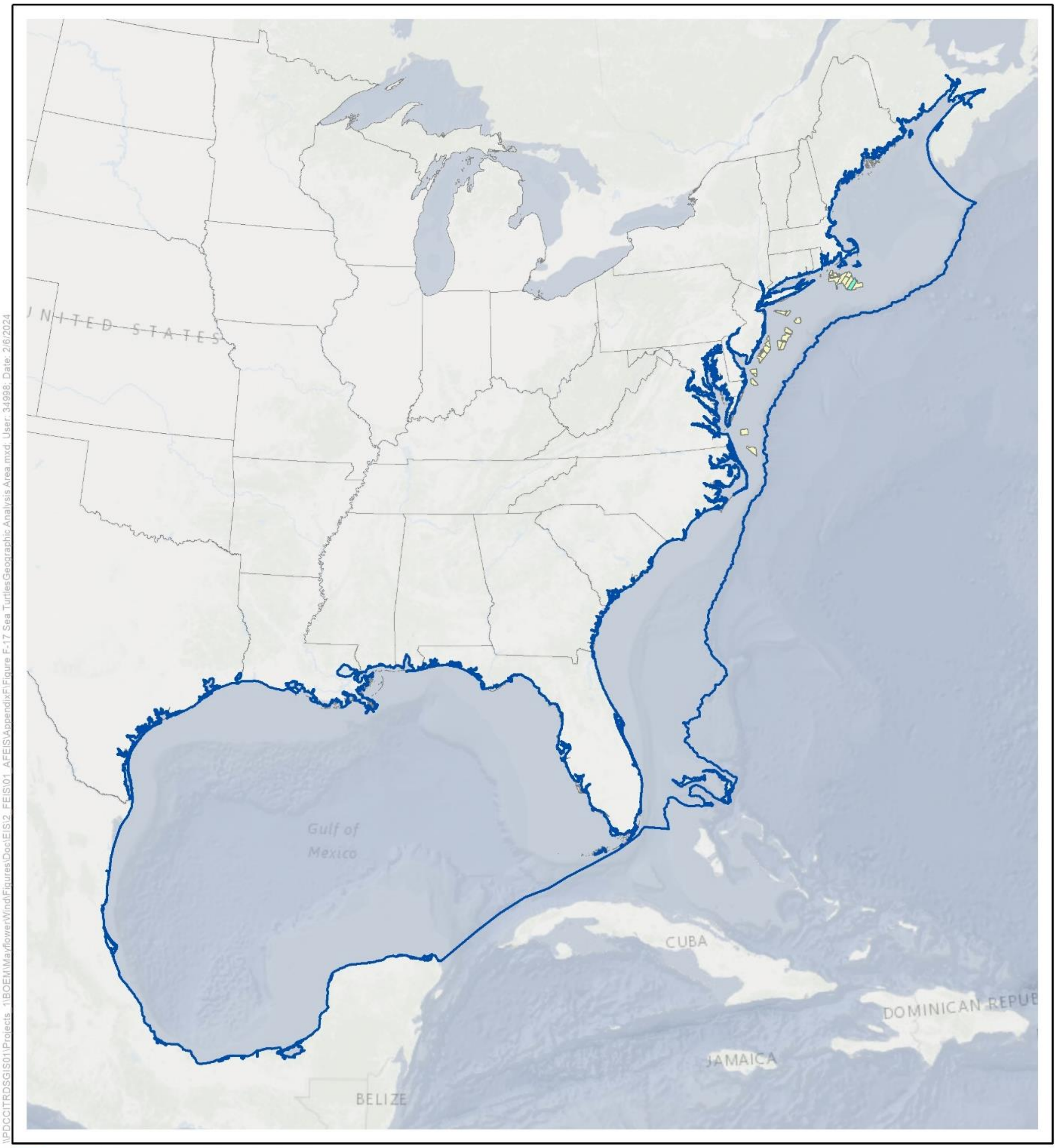
3.5 Biological Resources

3.5.7 Sea Turtles

This section discusses potential impacts on sea turtles from the proposed Project, alternatives, and ongoing and planned activities in the sea turtle geographic analysis area. The sea turtle geographic analysis area, as shown on Figure 3.5.7-1, encompasses three LMEs, namely the northeastern United States OCS LME, the southeastern United States OCS LME, and the Gulf of Mexico LME. These LMEs capture the movement range for sea turtle species that could be affected by the Project in U.S. Atlantic Ocean waters. Due to the size of the geographic analysis area, the analysis of IPFs of the proposed Project focuses on sea turtles that would likely occur near the Offshore Project area and have the potential to be affected by the Proposed Action.

3.5.7.1 Description of the Affected Environment

Four species of sea turtles are known to occur in or near the Project area, all of which are protected under the ESA (16 USC 1531 et seq.) and Massachusetts ESA and listed as a SGCN in Rhode Island. These include the leatherback sea turtle (*Dermochelys coriacea*), loggerhead sea turtle (*Caretta caretta*), Kemp’s ridley sea turtle (*Lepidochelys kempii*), and green sea turtle (*Chelonia mydas*). All four sea turtle species are highly migratory and are generally found in waters offshore southern Massachusetts and Rhode Island during the summer and fall (Kraus et al. 2016; Schwartz 2021). A fifth species of sea turtle, the hawksbill sea turtle (*Eretmochelys imbricata*), occurs in the larger geographic analysis area but is very unlikely to occur in the Project area because it typically inhabits tropical waters. While the hawksbill sea turtle has been recorded as far north as Massachusetts, hawksbills are exceedingly rare in the Offshore Project area and are more likely to be encountered in the Gulf of Mexico (NMFS and USFWS 1993; Kenney and Vigness-Raposa 2010). Vessel traffic is the only Project activity that could affect sea turtles in this region. Gulf of Mexico ports associated with the Project have a low likelihood of use. If they are used, a total of 80 trips are expected to be made across all Project phases. Given the relatively low number of vessel trips and the vessel strike avoidance measures that would be in place during a transit of the Gulf of Mexico (Section 3.5.7.5, *Impacts of Alternative B – Proposed Action on Sea Turtles*), impacts in the Gulf of Mexico are considered unlikely. The individual hawksbill sea turtles that have occasionally been documented in and near the southern New England area have been stunned by exposure to unusual cold water events and subsequently transported northward into the region by the Gulf Stream (Lutz and Musick 1997; NMFS and USFWS 1993).These occurrences are not representative of normal behaviors or distribution. The Proposed Action is unlikely to contribute to any measurable cumulative effects and, therefore, this species is not considered further. Table 3.5.7-1 lists the four sea turtle species and DPS that could occur in the North Atlantic coastal waters offshore Massachusetts and Rhode Island and provides the listing status and likelihood of occurrence in the Project area.



Sea Turtles Geographic Analysis Area
SouthCoast Wind (OCS-A 0521)
Other BOEM Lease Areas

Source: BOEM 2024.

N 0 200 400 Miles
1:19,000,000

Figure 3.5.7-1. Sea Turtle geographic analysis area

Table 3.5.7-1. Sea turtle species that may potentially occur in the Project area

Common Name	Scientific Name	DPS	ESA Status [a]	Frequency of Occurrence in Project Area	Seasonal Occurrence in Project Area
Leatherback sea turtle	*Dermochelys coriacea*	Not Applicable [b]	E	Common	June to November
Loggerhead sea turtle	*Caretta*	Northwest Atlantic	T	Common	May to November
Kemp's ridley sea turtle	*Lepidochelys kempii*	Not applicable	E	Possible	May to September
Green sea turtle	*Chelonia mydas*	North Atlantic	T	Possible	August to November

Sources: NMFS 2022; BOEM 2014.
[a] ESA status: E = Endangered, T = Threatened.
[b] National Marine Fisheries Service and U.S. Fish and Wildlife Service have not designated DPSs for leatherback sea turtles because the species is listed as endangered throughout its global range (85 FR 48332).
DPS = Distinct Population Segment, ESA = Endangered Species Act

Sea turtles inhabit tropical and subtropical seas throughout the world. In coastal U.S. waters, sea turtles are highly migratory and seasonally distributed, migrating to and from habitats extending from the Gulf of Mexico to New England, with overwintering concentrations in southern waters and nesting sites located on southern beaches from Virginia south through Florida. The four sea turtle species seasonally inhabit offshore waters in the Project area from May through November, including the area of direct effects. Green, leatherback, loggerhead, and Kemp's ridley sea turtles migrate north from warmer South Atlantic waters in the spring (May and June) to take advantage of abundant prey in warming northeastern embayments and estuaries, including Cape Cod Bay, when sea surface temperatures range from 61 to 79 degrees Fahrenheit (°F) (16 to 26 degrees Celsius[°C]) (CETAP 1981). Sea turtles return to southern waters as water temperatures decline in the fall and are unlikely to be present in the Project area after November 30. However, not all sea turtles leave the area during winter and there are occasional strandings of sea turtles that become incapacitated or "cold-stunned" at temperatures below 50°F (Still et al. 2005; Schwartz 1978).

Sea turtle nesting does not occur in Massachusetts or Rhode Island and there are no nesting beaches or other critical habitats in the vicinity of the Project (GARFO 2021). Individuals occurring in the Project area are either migrating or foraging and are likely to spend the majority of time below the surface. Sea turtles can remain underwater for extended periods, ranging from several minutes to several hours, depending on factors, such as daily and seasonal environmental conditions and specific behavioral activities associated with dive types (Hochscheid 2014). Such physiological traits and behavioral patterns allow them to spend as little as 3 to 6 percent of their time at the water's surface (Lutcavage and Lutz 1997). These adaptations are important because sea turtles often travel long distances between their feeding grounds and nesting beaches (Meylan 1995).

The combination of sightings, strandings, and bycatch data provides the best available information on sea turtle distribution in the Project area. This section summarizes data for each of the four sea turtle species from the most current sightings surveys of waters around the Massachusetts/Rhode Island offshore Wind Energy Area (Kraus et al. 2016; Palka et al. 2017; Palka et al. 2021), NMFS Sea Turtle

Stranding and Salvage Network (STSSN) (NMFS 2022), and recent and historic population or density estimates from NMFS and the U.S. Department of the Navy (U.S. Navy), where available. Population dynamics and habitat use of different sea turtle species along the Massachusetts and Rhode Island shore is still poorly understood. Sea turtles are wide-ranging and long-lived, making population estimates difficult, and survey methods vary depending on species (TEWG 2007; NMFS and USFWS 2013, 2015a, 2015b). Because sea turtles have large ranges and highly migratory behaviors, the current condition and trend of sea turtles are affected by factors outside of the proposed Project area.

The Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Rhode Island and Massachusetts (BOEM 2014) and COP Volume 2, Section 6.9.1 (SouthCoast Wind 2024) provide further details about each species' range and distribution, population status, ecology and life history, and conservation and management, summarized in the following subsections.

Leatherback Sea Turtle

The leatherback sea turtle is the largest living and the most widely distributed sea turtle species, ranging broadly from tropical and subtropical to temperate regions of the world's oceans (NMFS and USFWS 2013). Individuals in the Project area belong to the Northwest Atlantic population, which is one of seven leatherback populations globally. The breeding population (total number of adults) estimated in the North Atlantic is 34,000 to 94,000 (NMFS and USFWS 2013; TEWG 2007). NMFS and USFWS (2020) concluded that the Northwest Atlantic population has a total index of nesting female abundance of 20,659 females with a decreasing nest trend at nesting beaches with the greatest known nesting female abundance. The species is listed as endangered under the ESA (35 Federal Register 8491). It is also listed as endangered under the MESA and is considered SGCN in the Rhode Island Wildlife Action Plan (RIDEM 2015; Commonwealth of Massachusetts 2020). They feed almost exclusively on jellyfish, siphonophores, and salps (Eckert et al. 2012; NMFS and USFWS 2020). In a study tracking 135 leatherbacks fitted with satellite tracking tags, turtles were identified to inhabit waters with sea surface temperatures ranging from 52°F to 89°F (Bailey et al. 2012). Satellite telemetry has found the median sea surface temperature of leatherback habitat to be 65°F (18.3°C) (Dodge et al. 2014). The leatherback sea turtle dives the deepest of all sea turtles to forage and is thought to be more tolerant of cooler oceanic temperatures than other sea turtles. The study also found that oceanographic features, such as mesoscale eddies, convergence zones, and areas of upwelling, attracted foraging leatherbacks because these features are often associated with aggregations of jellyfish. Unlike the other three species, the leatherback does not use shallow waters to prey on benthic invertebrates or sea grasses.

Leatherback sea turtles undergo extensive migrations in the western North Atlantic and usually start arriving along the southern New England coast in late spring/early summer (Shoop and Kenney 1992; James et al. 2006). Recent and historic data indicate leatherback sea turtles are the most frequently observed sea turtle species in the Massachusetts/Rhode Island Wind Energy Area and occur primarily in the summer and fall, with particularly heavy presence south of Nantucket and in Muskeget Channel (COP Volume 2, Section 6.9.1.1.3, Figure 6-52; SouthCoast Wind 2024; Kraus et al. 2016; Kenney and Vingess-Raposa 2010; Whelchel and Clark 2010). From 2011 through 2021, STSSN reported 59 offshore and 242 inshore leatherback sea turtle strandings in Zone 41, which encompasses the Project area in Sothern New England (NMFS 2022). Based on survey information collected in the region to date, BOEM expects leatherback sea turtles to be common in the Project area from June to November (Table 3.5.7-1). Modeled density estimates in the Project area by season can be found in COP Volume 2, Section 6.9.1.1.3, Figure 6-53 (SouthCoast Wind 2024).

Leatherback sea turtles were the most frequently sighted species of turtle sighted in the Lease Area during aerial surveys from 2011 to 2015, and were mostly sighted during the summer and autumn, rarely in the spring, and not at all in winter (Kraus et al. 2016). Only one leatherback turtle was observed in the Lease Area from aerial surveys from 2017 through 2018. Eight sea turtles from two species were identified during the Campaign 5 aerial surveys (O'Brien et al. 2021a). Six leatherback turtle sightings occurred in June and August of 2017 through 2019. Leatherback turtles were sighted on three separate days, all directly south of Nantucket and fairly close to shore (within 10 nm). During 2020 Campaign 6A aerial surveys, three leatherback sea turtles were observed during general surveys (O'Brien et al. 2021b). All leatherback turtle sightings except one were over the Nantucket Shoals.

Loggerhead Sea Turtle

Loggerhead sea turtles range widely and have been observed along the entire Atlantic Coast as far north as Canada (Brazner and McMillan 2008; Ceriani et al. 2014; Shoop and Kenney 1992). Analysis of tagged loggerhead sea turtles suggests the highest population densities are in the shelf waters of the US coast from Florida to North Carolina. Waters of the Mid-Atlantic Bight have been found to be an important summer foraging habitat (Winton et al. 2018). Sightings most often occur in surface waters with temperatures between 44°F and 86°F, or 7°C and 30°C (Shoop and Kenney 1992). They have a general omnivorous diet and are benthic feeders, consuming vegetation, zooplankton, crabs, mollusks, jellyfish, fish, and various other invertebrates (Dodd 1988; Seney and Musick 2007). The regional abundance estimate in the Northwest Atlantic OCS in 2010 was approximately 588,000 adults and juveniles of sufficient size to be identified during aerial surveys (interquartile range of 382,000 to 817,000 [NEFSC and SEFSC 2011]). The three largest nesting subpopulations responsible for most of the production in the western North Atlantic (peninsular Florida, northern United States, and Quintana Roo, Mexico) have all been declining since at least the late 1990s, thereby indicating a downward trend for this population (TEWG 2009). Loggerhead sea turtles in the Project area belong to the Northwest Atlantic DPS, which is listed as threatened under the ESA (76 *Federal Register* 58868). The species is also listed as threatened under the MESA and is considered SGCN in the Rhode Island Wildlife Action Plan (RIDEM 2015; Commonwealth of Massachusetts 2020). While some progress has been made since publication of the 2008 Loggerhead Sea Turtle Recovery Plan, the recovery units have not met most of the critical benchmark recovery criteria (NMFS and USFWS 2019). The Atlantic Marine Assessment Program for Protected Species turtle tagging data recorded limited loggerhead sea turtle observations in the Massachusetts/Rhode Island Wind Energy Area between 2009–2015; however, visual surveys conducted between 2010–2017 indicated regular presence in waters near the Project area in the summer and fall (COP Volume 2, Section 6.9.1.1.4, Figure 6-54, SouthCoast Wind 2024; Palka et al. 2017, 2021). From 2011 through 2021, STSSN reported 68 offshore and 201 inshore loggerhead sea turtle strandings in Zone 41, which encompasses the Project area in Southern New England (NMFS 2022). Additionally, the

U.S. Navy indicates that loggerhead sea turtles are expected to occur commonly as non-breeding adults, subadults, and juveniles from the late spring through fall, with the highest probability of occurrence from July through September (U.S. Navy 2017b). Based on this information, BOEM expects loggerhead sea turtles to be common in the Massachusetts/Rhode Island Wind Energy Area and likely in the Project area from May to November (Table 3.5.7-1). Modeled density estimates in the Project area by season can be found in COP Volume 2, Section 6.9.1.1.4, Figure 6-54 (SouthCoast Wind 2024).

Kemp's Ridley Sea Turtle

Kemp's ridley sea turtles are most commonly found in the Gulf of Mexico and along the U.S Atlantic Coast. Juvenile and subadult Kemp's ridley sea turtles are known to travel as far north as Cape Cod Bay during summer foraging (NMFS et al. 2011). All Kemp's ridley sea turtles belong to a single population that is endangered under the ESA (35 *Federal Register* 183290). The species is also listed as endangered under the MESA and is considered SGCN in the Rhode Island Wildlife Action Plan (RIDEM 2015; Commonwealth of Massachusetts 2020). The species is primarily associated with habitats on the OCS, with preferred habitats consisting of sheltered areas along the coastline, including estuaries, lagoons, and bays (Burke et al. 1994; NMFS 2019) and nearshore waters less than 120 feet deep (Shaver et al. 2005; Shaver and Rubio 2008), although they can also be found in deeper offshore waters. The population was severely reduced prior to 1985 due to intensive egg collection and fishery bycatch, with a low in 1985 of 702 nests counted from an estimated 250 nesting females on three primary nesting beaches in Mexico (NMFS and USFWS 2015a). Recent estimates of the total population of age 2 and older is 248,307 with a total of 12,179 nests documented in Mexico and Texas in 2014. The most recent estimates of abundance (age 2 and older) and number of nests indicate a stall in growth after over a decade of consistent increase, suggesting that the population is not currently recovering to historical levels (NMFS and USFWS 2015a). Kemp's ridley sea turtles regularly occur in inshore and nearshore waters of Rhode Island, including Narraganset Bay, in the summer and fall to forage for crabs in submerged aquatic vegetation (Schwartz 2021). In waters further offshore, visual sighting data are limited because this small species is difficult to observe using typical aerial survey methods; however, rare observations have been made in the Massachusetts/Rhode Island Wind Energy Area in the summer and fall (Kraus et al. 2016). From 2011 through 2021, STSSN reported 16 offshore and 172 inshore Kemp's ridley sea turtle strandings in Zone 41, which encompasses the Project area in southern New England (NMFS 2022). Based on this information, Kemp's ridley sea turtles could occur infrequently as juveniles and subadults from July through September, potentially occurring as late as November. The highest likelihood of occurrence is in coastal nearshore areas as they seek protected shallow-water habitats near Cape Cod Bay. BOEM expects Kemp's ridley sea turtles to be in the Project area from May to November, but its co-occurrence with Project activities is expected to be uncommon due to relatively low numbers in northeastern U.S. waters. Modeled density estimates in the Project area showing no differences by season can be found in the SouthCoast Wind COP Volume 2, Section 6.9.1.1.2, Figure 6-51 (SouthCoast Wind 2024).

Green Sea Turtle

Green sea turtles are found in tropical and subtropical waters around the globe; however, juveniles and subadults are occasionally observed in Atlantic coastal waters as far north as Massachusetts (Greene et al. 2010). They are most commonly observed feeding in the shallow waters of reefs, bays, inlets, lagoons, and shoals that are abundant in algae or marine grass (NMFS and USFWS 2007a). Green turtles do not nest on beaches in the Project area; their primary nesting beaches are in Costa Rica, Mexico, the United States (Florida), and Cuba. Green sea turtles in the Project area belong to the North Atlantic DPS, which is listed as threatened under the ESA (81 *Federal Register* 20057), while breeding populations in Florida are listed as endangered (81 *Federal Register* 20058, 2016). The species is also listed as threatened under the MESA and is considered SGCN in the Rhode Island Wildlife Action Plan (RIDEM 2015; Commonwealth of Massachusetts 2020). The most recent status review for the North Atlantic DPS estimates the number of female nesting turtles to be approximately 167,424 individuals (NMFS and USFWS 2015b). According to NMFS and USFWS (2015b), nesting trends are generally increasing for this population. Because of their association with warm waters, green turtles are relatively uncommon in Rhode Island and Massachusetts waters but have been observed on rare occasions in the summer (BOEM 2014). Green turtles are commonly associated with drift lines or surface current convergences, which commonly contain floating Sargassum capable of providing small turtles with shelter and sufficient buoyancy to raft upon (Thiel and Gutow 2005; Witherington et al. 2012). They rest underwater in coral recesses, the underside of ledges, and sand-bottom areas that are relatively free of strong currents and disturbance from natural predators and humans. From 2011 to 2021, STSSN reported four offshore and 75 inshore green sea turtle strandings in Zone 41, which encompasses the Project area in southern New England (NMFS 2022). Based on this information and a lack of sightings near the Massachusetts/Rhode Island Wind Energy Area (COP Volume 2, Section 6.9.1.1.1, Figure 6-50; SouthCoast Wind 2024; Whelchel and Clark 2010), the occurrence of green sea turtles in the Project area is expected to be uncommon and limited to small numbers.

Sea turtles in the geographic analysis area are subject to a variety of ongoing human-caused impacts, including collisions with vessels, entanglement with fishing gear, fisheries bycatch, dredging, anthropogenic noise, pollution, disturbance of marine and coastal environments, effects on benthic habitat, accidental fuel leaks or spills, waste discharge, and climate change. Sea turtle migrations can cover long distances, and these factors can have impacts on individuals over broad geographical scales. Climate change has the potential to affect the distribution and abundance of prey due to changing water temperatures, ocean currents, and increased acidity.

3.5.7.2 Impact Level Definitions for Sea Turtles

Impact level definitions for sea turtles are provided in Table 3.5.7-2.

Table 3.5.7-2. Definitions of impact levels for sea turtles

Impact Level	Type of Impact	Definition
Negligible	Adverse	Impacts on sea turtles would be undetectable or barely measurable, with no consequences to individuals or populations.
	Beneficial	Impacts on sea turtles would be undetectable or barely measurable, with no consequences to individuals or populations.
Minor	Adverse	Impacts on sea turtles would be detectable and measurable, but of low intensity, highly localized, and temporary or short term in duration. Impacts may include injury or loss of individuals, but these impacts would not result in population-level effects.
	Beneficial	Impacts on sea turtles would be detectable and measurable, but of low intensity, highly localized, and temporary or short term in duration. Impacts could increase survival and fitness but would not result in population-level effects.
Moderate	Adverse	Impacts on sea turtles would be detectable and measurable and could result in population-level effects. Adverse effects would likely be recoverable and would not affect population or DPS viability.
	Beneficial	Impacts on sea turtles would be detectable and measurable and could result in population-level effects. Impacts would be measurable at the population level.
Major	Adverse	Impacts on sea turtles would be significant and extensive and long term in duration and could have population-level effects that are not recoverable, even with mitigation.
	Beneficial	Impacts would be significant and extensive and contribute to population or DPS recovery.

3.5.7.3 Impacts of Alternative A – No Action on Sea Turtles

When analyzing the impacts of the No Action Alternative on sea turtles, BOEM considered the impacts of ongoing activities, including ongoing non-offshore wind and ongoing offshore wind activities on the baseline conditions for sea turtles. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities, as described in Appendix D, *Planned Activities Scenario*.

Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for sea turtles described in Section 3.5.7.1, *Description of the Affected Environment and Future Baseline Conditions,* would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities. Ongoing non-offshore wind activities in the geographic analysis area that contribute to impacts on sea turtles are generally associated with coastal and offshore development, marine transport, fisheries use, and climate change. Coastal and offshore development, marine transport, and fisheries use and associated impacts are expected to continue at current trends and have the potential to affect sea turtles through accidental releases, which can have physiological effects on sea turtles; EMF and light, which can result in behavioral changes in sea turtles; new cable emplacement and maintenance and port utilization, which can disturb benthic habitats and affect water quality; noise, which can have physiological and behavioral effects on sea turtles; the presence of structures, which can result in behavioral changes in sea turtles, effects on prey species, and increased risk of interactions with fishing gear; and vessel traffic, which increases risk of vessel collision.

Interactions with fisheries is considered a significant threat to sea turtle species. Incidental bycatch in commercial and artisanal fisheries have the potential to kill or injure sea turtles, especially the use of gill net, trawl, and dredge fishing gear (NMFS and USFWS 2015a, 2015b). Reduction of sea turtle interactions with fisheries is a priority where these species occur. Finkbeiner et al. (2011) compiled sea turtle bycatch in U.S. fisheries and found that in the Atlantic, a mean estimate of 137,700 interactions, of which 4,500 were lethal, occurred annually since the implementation of bycatch mitigation measures. However, a vast majority (98 percent) of the interactions and mortalities (80 percent) occurred in the Southeast/Gulf of Mexico shrimp trawl fishery, although sampling inconsistencies and limitations should be considered when interpreting this data.

Global climate change is an ongoing risk for sea turtle species in the geographic analysis area and could result in population-level impacts on sea turtle species by displacement, impacts on prey species, altered population dynamics, and increased mortality. It is well established that climate change has the potential to affect the distribution and abundance of sea turtles and their prey due to changing water temperatures, ocean currents, and increased acidity. Furthermore, rising sea levels and increased storm intensity may negatively affect turtle nesting beaches. Increasing air temperatures can affect sea turtle population structure because temperature-dependent sex determination of embryos would result in a shift toward more female-biased sex ratios (Poloczanska et al. 2009). Patel et al. (2021) used global climate models to predict that the future distribution of suitable thermal habitat for loggerheads along the OCS will likely increase in northern regions. Sea turtle nesting could also shift northward on the U.S. Atlantic Coast. Because these changes may impact sea turtle reproduction, survival, and demography, the impacts of climate change on sea turtles are expected to be minor.

The following ongoing offshore wind activities in the geographic analysis area would contribute to impacts on sea turtles (based on the scenario shown in Appendix D).

- Continued O&M of three offshore wind projects:
  - BIWF Project (5 WTGs) installed in state waters.
  - SFWF Project (12 WTGs and 1 OSP) installed in OCS-A 0517.
  - CVOW Pilot Project (2 WTGs) installed in OCS-A 0497.
- Ongoing construction of eight offshore wind projects:
  - Vineyard Wind 1 Project (62 WTGs and 1 OSP) in OCS-A 0501.
  - Revolution Wind Project (65 WTGs and 2 OSSs) in OCS-A 0486.

- Sunrise Wind Project (94 WTGs and 1 OSP) in OCS-A 0487.
- New England Wind Project (128 WTGs and 2 OSSs) in OCS-A 0534 and a portion of OCS-A 0501.
- Empire Wind Project (138 WTGs and 2 OSSs) in OCS-A 0512.
- Ocean Wind 1 Project (98 WTGs and 3 OSSs) in OCS-A 0498.
- Atlantic Shores South Project (195 WTGs and 2 OSSs) in OCS-A 0499.
- CVOW-C Project (176 WTGs and 3 OSSs) in OCS-A 0483.

Ongoing offshore wind activities would affect sea turtles through the primary IPFs of noise, presence of structures, and vessel traffic. Ongoing offshore wind activities would have the same type of impacts from IPFs that are described in *Cumulative Impacts of the No Action Alternative* for planned offshore wind activities, but the impacts would be of lower intensity.

Impacts of Alternative A on ESA-Listed Species

All sea turtle species in the geographic analysis area are either threatened or endangered and protected by ESA. Impacts of Alternative A on ESA-listed sea turtles are discussed in the previously listed IPFs. Any future federal or private activities that could affect federally listed sea turtles in the geographic analysis area would need to comply with ESA Section 7 or Section 10, respectively, to ensure that the proposed activities would not jeopardize the continued existence of the species.

Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative in combination with other planned non-offshore wind activities and planned offshore wind activities (without the Proposed Action). Planned non-offshore wind activities that may contribute to impacts on sea turtles include commercial fisheries bycatch; marine transportation; military use; oil and gas activities; undersea transmission lines, gas pipelines, and other submarine cables; tidal energy projects; dredging and port improvement; and marine minerals use and ocean dredged material disposal (see Appendix D, *Planned Activities Scenario*, Section D.2, for a description of planned activities). BOEM expects planned activities other than offshore wind to affect sea turtles through several primary IPFs, including accidental releases, EMF, light, new cable emplacement and maintenance, port utilization, noise, the presence of structures, and traffic. Refer to Table D1-20 in Appendix D for a summary of potential impacts associated with planned non-offshore wind activities by IPF for sea turtles.

The following sections summarize the potential impacts of ongoing and planned offshore wind activities on sea turtles during construction, O&M, and decommissioning of the projects. Other offshore wind activities in the geographic analysis area for sea turtles include the construction, O&M, and decommissioning of approximately 34 offshore wind projects (Appendix D, Table D-2).

BOEM expects planned offshore wind activities to affect sea turtles through the following primary IPFs.

Accidental releases: Accidental releases of fuel, fluids, hazardous materials, trash, and debris may increase as a result of offshore wind activities. Marine pollution is an ongoing threat, as sea turtle ingestion of human trash and debris has been observed in all species of sea turtles (Bugoni et al. 2001; Hoarau et al. 2014; Nelms et al. 2016; Schuyler et al. 2014). Ingestion often occurs when sea turtles mistake debris for potential prey items (Gregory 2009; Hoarau et al. 2014; Thomás et al. 2002). Although the threat varies among species and life stages due to differing feeding, plastic ingestion is an issue for marine turtles from the earliest stages of life (Eastman et al. 2020) and the volume of debris ingested is related to the size of the turtles (Thomás et al. 2002). In addition to plastic debris, ingestion of tar, paper, Styrofoam, wood, reed, feathers, hooks, lines, and net fragments has also been documented in loggerhead sea turtles. Trash and debris may be released by vessels during construction, operations, and decommissioning of ongoing and planned offshore wind facilities. These sublethal effects would affect individual fitness, but mortality and sublethal effects associated with ingestion of trash and debris are not expected to have population-level effects. Such releases are expected to be small and infrequent.

Unexpected or unanticipated events, including vessel collisions or allisions, events that would result in equipment failure, or oil spills and chemical releases could occur during the construction, operations, or decommissioning phases of offshore wind projects. Such an incident occurred on July 2024 where structural damage to a turbine blade at Vineyard Wind 1 offshore wind farm caused the blade to detach while undergoing testing, resulting in debris to accumulate in the water and some washing ashore around Nantucket, Vineyard, and Rhode Island sounds (Vineyard Wind 2024a). Based on preliminary investigations conducted by Arcadis US Inc. (2024), the blade materials and debris comprise fiberglass, semi-rigid foam, and polyester resins similar to materials that can be found in textiles, boat construction, and the aviation industry. These stable physical and chemical properties are also the basis for the acceptance of the blades for landfill disposal once retired, as non-toxic, non-hazardous, solid waste materials. Further evaluations will consider the potential for degradation of the residual blade materials that remain in the environment and potential exposure routes and other fate and transport mechanisms. While structural failures as considered low-probability events, offshore wind developers are required to develop a comprehensive federally approved emergency response plan to address these scenarios as part of the permitting process. Vineyard Wind and GE Vernova have since conducted root cause analyses, debris recovery efforts and debris containment, and shoreline cleanup operations and are engaged with federal (including BSEE and USCG), state, tribal, and local stakeholders to ensure the health and safety of its workforce, mariners, and the environment (Vineyard Wind 2024b).

Planned offshore wind development would require large quantities of coolant fluids, oils and lubricants, and diesel fuel (see Appendix D, Table D2-3 for specific quantities). Accidental releases of fuel, fluids, and hazardous materials may increase as a result of both ongoing and planned offshore wind activities. The risk of any type of accidental release would be increased primarily during construction when Project vessels are present, and also during operations and decommissioning of offshore wind facilities. In the planned activities scenario, there would be a low risk of a leak of fuel/fluids/hazardous materials from any single one of approximately 2,945 WTGs and OSPs, each with on average 8,400 gallons (31,797 liters) stored. Total fuel/fluids/hazardous materials in the geographic analysis area would be approximately 24.7 million gallons (93.5 million liters; Appendix D, Table D2-3). According to BOEM's modeling (Bejarano et al. 2013), a release of 128,000 gallons is likely to occur no more often than once per 1,000 years, and a release of 2,000 gallons or less is likely to occur every 5 to 20 years. The likelihood of a spill occurring from multiple WTGs and OSP at the same time is very low; therefore, the potential impacts from a spill larger than 2,000 gallons are largely discountable.

Accidental releases of fuels, fluids, and hazardous materials can have both physical and chemical effects on sea turtles that negatively influence the health and survival of affected individuals (Shigenaka et al. 2021). Physical effects are typically observed at the surface and commonly involve hatchlings and juvenile turtles, who spend most of their time at the surface. These effects limit basic functionality for most turtles exposed because oil interferes with surface breathing, movement, and vision, which limits their ability to forage or evade predators (Shigenaka et al. 2021). Chemical effects are less apparent and, therefore, less understood; however, studies have observed skin lesions, dehydration, oxidative stress, failed weight gain in hatchlings, and inflammation of skin and organs (Shigenaka et al. 2021; Mitchelmore et al. 2015; Harms et al. 2014). Impacts resulting from accidental releases may pose a long-term risk to sea turtles and could potentially lead to mortality and sublethal impacts on individuals present in the vicinity of the spill, but the potential for exposure would be minor given the isolated and low-volume nature of potential accidental releases and the variable distribution of sea turtles in the geographic analysis area. Given the volumes of fuels, fluids, and hazardous materials potentially involved and the likelihood of release occurrence, the increase in accidental releases associated with planned offshore wind activities is expected to fall within the range of releases that occur on an ongoing basis from non-offshore wind activities. Impacts from accidental releases and discharges associated with ongoing and planned construction and operation of offshore wind projects have been previously analyzed and were found to be negligible because of the low probability, short-term duration, and highly localized nature of accidental releases (BOEM 2021a, 2021b). Offshore wind projects will comply with their Oil Spill Response Plan and USCG requirements for the prevention and control of oil and fuel spills.

Cable emplacement and maintenance: Ongoing and planned offshore wind activities will involve the placement and maintenance of export and interarray cables. Cable emplacement associated with ongoing and planned offshore wind activities (not including the Proposed Action) is expected to disturb more than 181,882 acres (73,605 hectares) of seabed while associated undersea cables are installed, causing an increase in suspended sediment (Appendix D, Table D2-2). Cable emplacement may occur from a variety of methods that include trenching devices, plows, and jetting and are dependent upon seabed sediments. During cable installation, sediment plumes would be present for up to 6 hours at a time until the activity is completed and suspended sediments settle back to the seabed. Areas subject to cumulative increases in suspended sediment from simultaneous activities would be limited because the occurrence of concurrent cable installation operations is expected to be limited. The increases in suspended sediment associated with new cable emplacement and maintenance would be short term and localized to the cable corridor.

There are no data on the physiological effects of suspended sediment on sea turtles. However, elevated suspended sediment may cause sea turtles to alter their normal movements and behaviors, as sea turtles would be expected to avoid the area of elevated suspended sediment. Such alterations are expected to be too small to be detected (NMFS 2020a). Negligible impacts are anticipated if sea turtles swim through the area of elevated suspended sediment. Suspended sediment only has the potential to affect sea turtles if the area of elevated concentrations acts as a barrier to normal behaviors. However, negligible impacts are anticipated due to sea turtles avoiding or swimming through areas of elevated suspended sediment (NMFS 2020a). In addition to direct effects on sea turtle behavior, suspended sediment can indirectly affect sea turtles through impacts on prey species, including benthic mollusks, crustaceans, sponges, and sea pens. Elevated suspended sediment concentrations are shown to have minor to moderate impacts on benthic communities when they exceed 390 mg/L (NMFS 2020a). See Section 3.5.5*, Finfish, Invertebrates, and Essential Fish Habitat*, for a discussion of cable emplacement impacts on prey species.

Dredging for sand wave clearance may be necessary in places to ensure cable burial below mobile seabed sediments, which could contribute to additional impacts on sea turtles related to impingement, entrainment, and capture associated with mechanical and hydraulic dredging techniques. Dredging may occur offshore, for cable laying or seabed preparation for foundations, or inshore at landfall locations. Mechanical dredging is not expected to capture, injure, or kill sea turtles (NMFS 2020b). Sea turtles are generally not vulnerable to entrainment in hydraulic dredges due to the small intake and relatively low intake velocity (NRC 1990). Hopper dredges may strike, impinge, or entrain sea turtles, which may result in injury or mortality (Ramirez et al. 2017 citing Dickerson et al. 1990; Ramirez et al. 2017 citing Dickerson et al. 1991; Ramirez et al. 2017 citing Reine et al. 1998; Ramirez et al. 2017 citing Richardson 1990). The sea turtle species most often affected by dredge interactions is loggerhead sea turtles, followed by green sea turtles, then Kemp's ridley sea turtles (Ramirez et al. 2017). However, the risk of interactions between hopper dredges and individual sea turtles is expected to be lower in the open ocean areas where dredging may occur compared to nearshore navigational channels where sea turtles are more concentrated in a constrained operating environment (Michel et al. 2013; USACE 2020). This may be due to the lower density of sea turtles in these areas, as well as differences in behavior and other risk factors. Disturbance of soft-bottom habitat in offshore wind cable corridors due to dredging could potentially affect Kemp's ridley sea turtles, which forage in this type of habitat. However, such disturbance would be temporary and would affect a relatively small area of available habitat. Therefore, effects of benthic habitat disturbance due to dredging would be too small to be meaningfully measured or detected.

Dredging within nearshore areas could affect green sea turtle habitat by directly removing SAV or creating suspended sediments that may be deposited on top of seagrass. To mitigate this risk, it is anticipated that ongoing and planned offshore wind projects would perform SAV surveys and avoid these areas during construction, to the extent practicable. Changes in turbidity and suspended sediments could temporarily disrupt normal sea turtle behaviors, especially if turtles rely on vision to forage. Sea turtles may experience behavioral effects upon exposure to turbidity or suspended sediments and become more susceptible to other threats like vessel strikes, but this has not been studied or measured. There are also no studies that evaluate the behavioral effects of suspended sediments on mobile prey species, and Johnson (2018) suggested that any effects on sea turtle prey species from suspended sediments, sediment deposition, or turbidity may cause turtles to move to other areas and then return to the affected areas at some time in the future. It is not believed that dredging would permanently change the sea turtle prey base (Michel et al. 2013) and planned offshore wind projects would implement turbidity reduction measures to contain the silt and sediment stirred up by dredging.

Given the available information, the risk of injury or mortality of individual sea turtles resulting from dredging necessary to support offshore wind project construction would be minor and population-level effects are unlikely to occur.

Discharges/intakes: Increases in vessel discharges would occur during construction and installation, O&M, and decommissioning of offshore wind development. Offshore permitted discharges include uncontaminated bilge water and treated liquid wastes. Increases would be greatest during construction and decommissioning of offshore wind projects. Discharge rates would be staggered according to project schedules and localized. Certain discharges are required to comply with permitting standards that are established to minimize potential impacts on the environment.

Other offshore wind projects in the geographic analysis area may use HVDC converter OSPs that would convert AC to DC before transmission to onshore project components. As described in a recent white paper produced by BOEM (Middleton and Barnhart 2022), these HVDC systems are cooled by an open loop system that intakes cool sea water and discharges warmer water back into the ocean. Entrainment and impingement of sea turtle prey could occur at HVDC converter intakes on the OSPs. Impacts of entrainment and impingement on sea turtle prey at HVDC converter intakes would be limited to the immediate area of the OSPs and to intake volumes.

Additionally, entrainment and impingement would occur at intakes for cable-laying equipment. Impacts on sea turtles and their prey from entrainment and impingement at intakes are expected to be localized and minor. Further, as discussed under the *Cable emplacement and maintenance* IPF, entrainment and impingement at cable-laying equipment intakes would be short term.

EMFs: Ongoing and planned offshore wind activities would install export and interarray cables, increasing the production of EMFs and heat in the geographic analysis area. EMFs and heat effects would be reduced by cable burial to an appropriate depth and shielding, if necessary. Cables are also expected to be separated by a minimum distance of 330 feet (100 meters), avoiding additive effects from adjacent cables. Sea turtles are capable of detecting magnetic fields (e.g., Lohmann and Lohmann 1996; Normandeau et al. 2011; Putman et al. 2015), and behavioral responses to such fields have been documented (e.g., Luschi et al. 2007). The threshold for behavioral responses varies somewhat among species. Sea turtles appear to have a detection threshold of magnetosensitivity and behavioral responses to field intensities ranging from 0.0047 to 4,000 microteslas (μT) for loggerhead turtles, and 29.3 to 200 μT for green turtles, with other species likely similar due to anatomical, behavioral, and life history similarities. A review of ten offshore wind farm cable systems found an average EMF output of 7.8 μT and a maximum of 14 μT. However, this average may increase as offshore wind technology continues to develop (Normandeau et al. 2011). In the planned activities scenario, up to 32,537 miles (52,363 kilometers) of offshore export cable and interarray cable would be added in the geographic analysis area for sea turtles, producing EMFs in the vicinity of each cable during operations (Appendix D,

Table D2-1). Submarine power cables in the geographic analysis area for sea turtles are assumed to be installed with appropriate shielding and burial depth to reduce a potential EMF from cable operation to low levels.

Juvenile and adult sea turtles may detect the EMF over relatively small areas near cables (e.g., when resting on the bottom or foraging on benthic organisms near cables or concrete mattresses). There are no data on EMF impacts on sea turtles associated with underwater cables. Migratory disruptions have been documented in sea turtles with magnets attached to their heads (Luschi et al. 2007), but evidence that EMFs associated with future offshore wind activities would likely result in some deviations from direct migration routes is lacking (Snoek et al. 2016). Any deviations are expected to be minor (Normandeau et al. 2011), and any increased energy expenditure due to these deviations would not be biologically significant.

Buried submarine cables can warm the surrounding sediment in contact with the cables up to tens of centimeters (Taormina et al. 2018). There are no data on cable heat effects on sea turtles (Taormina et al. 2018). However, increased heat in the sediment could affect benthic organisms that serve as prey for sea turtles that forage in the benthos. Based on the narrowness of cable corridors and expected weakness of thermal radiation, impacts on benthic organisms are not expected to be significant (Taormina et al. 2018) and would be limited to a small area around the cable. Given the expected cable burial depths, thermal effects would not occur at the surface of the seabed where sea turtles would forage. Therefore, any effects on sea turtle prey availability would be negligible and too small to be detected or meaningfully measured.

Gear utilization: Offshore wind activities are expected to include monitoring surveys in the project areas. Sea turtles could be affected by these surveys through survey vessel traffic and interactions with survey gear. Survey vessels would produce underwater noise and increase the risk of vessel strikes. The effects of vessel noise and increased strike risk would be similar to those discussed under the *Noise* and *Traffic* IPFs. Additional impacts on sea turtles could result from interactions with mobile (e.g., trawl, dredge) or fixed (e.g., trap, hydrophone) survey gear. Offshore wind projects are expected to use trawl surveys, among other methods, for project monitoring. The capture and mortality of sea turtles in fisheries utilizing bottom trawls are well documented (Henwood and Stuntz 1987; NMFS and USFWS 1991, 1992; NRC 1990). Although sea turtles are capable of extended dive durations, entanglement and forcible submersion in fishing gear leads to rapid oxygen consumption (Lutcavage and Lutz 1997). Based on available research, restricting tow times to 30 minutes or less is expected to prevent sea turtle morality in trawl nets (Epperly et al. 2002; Sasso and Epperly 2006). BOEM anticipates trawl surveys for offshore wind project monitoring would be limited to tow times of 20 minutes, indicating that this activity poses a minor risk of mortality. Additional mitigation measures would be expected to reduce the risk of serious injury and mortality from forced submergence for sea turtles caught in bottom-trawl survey gear. Tows for clam dredge surveys would have a very short duration of 120 seconds, and the survey vessels would be subject to mitigation measures similar to those for the trawl survey. While mitigation measures would reduce interactions with sea turtles, the potential for incidental capture and entanglement cannot be discounted should an individual be encountered during trawl or dredge use.

Therefore, following best practices, effects of trawl and dredge surveys on sea turtles would be minor, as it would not be expected to have population-level impacts on sea turtles.

The vertical buoy and anchor lines associated with monitoring surveys using fixed gear, such as fish traps or baited remote underwater video, could pose a risk of entanglement for sea turtles. While there is a theoretical risk of sea turtle entanglement in trap and pot gear, particularly for leatherback sea turtles (NMFS 2016), the likelihood of entanglement would be unlikely given the patchy distribution of sea turtles, the small number of vertical lines used in the surveys, and the relatively limited duration of each sampling event. BOEM also anticipates mitigation measures would be in place to reduce sea turtle interactions during fisheries surveys. Sea turtle prey species (e.g., crabs, whelks, fish) may be collected as bycatch in trap gear. However, all bycatch is expected to be returned to the water and would still be available as prey for sea turtles regardless of their condition, particularly for loggerhead sea turtles, which are known to forage for live prey and scavenge dead organisms. Given the non-extractive nature of fixed gear surveys, any effects on sea turtles from the collection of potential sea turtle prey would be so small that it cannot be meaningfully measured. Therefore, indirect effects on sea turtles due to collection of potential prey items would be negligible.

Hydrophone mooring lines for passive acoustic monitoring studies pose a theoretical entanglement risk to sea turtles, similar to trap and pot surveys. However, BOEM anticipates that monitoring studies utilizing moored systems would be required to use the best available technology to reduce any potential risks of entanglement. Therefore, passive acoustic studies are not expected to pose a meaningful risk of entanglement to sea turtles. Monitoring surveys are expected to occur at short-term, regular intervals over the duration of the monitoring program. Although the potential extent and number of animals potentially exposed cannot be determined without project-specific information, impacts of gear utilization on sea turtles are expected to be minor given the low risks of mortality and entanglement and the negligible effect on sea turtle prey availability.

Lighting: The impacts of coastal development affect sea turtles primarily through habitat loss from development and artificial lighting near sea turtle nesting areas. Artificial light on nesting beaches or in nearshore habitats has the potential to result in disorientation to nesting females and hatchling turtles up to about 3 miles (4.8 kilometers) from the light source (Orr et al. 2013) as correlated by a study that shows an inverse relationship between sea turtle nest numbers and the presence of artificial light (Mazor et al. 2013). It is, however, anticipated that in places where sea turtles nest, there will be an increase in the adoption of state and local lighting ordinances. Within the geographic analysis area, lighting impacts related to wind activities on nesting beaches would be limited to onshore areas south of Virginia as long-established sea turtle nesting beaches do not occur north of Virginia (CETAP 1981). Therefore, the majority of sea turtle nesting beaches are not within range to receive any impacts from lighting effects related to offshore wind activities.

Vessels and offshore structures associated with ongoing and planned offshore wind activities produce light at night that could elicit attraction, avoidance, or other behavioral responses in sea turtles. Ocean vessels have an array of lights including navigational, deck, and interior lights. Such lights have some potential to attract sea turtles, although impacts, if any, are expected to be localized and temporary due to the transitory nature of the effect. In laboratory experiments, juvenile loggerhead sea turtles consistently oriented toward lightsticks of various colors and types used by pelagic longline fisheries (Wang et al. 2019), indicating that hard-shelled sea turtle species expected to occur in the vicinity of offshore wind projects (i.e., green, Kemp's ridley, and loggerhead) could be attracted to offshore light sources. In contrast, juvenile leatherback sea turtles do not appear to be attracted to light in laboratory experiments (Gless et al. 2008), indicating that this species may not be attracted to offshore lighting. Gless et al. (2008) also reviewed previous studies based on fisheries logbook data and concluded that because of confounding factors, there is no convincing evidence that marine turtles are attracted to lights used in longline fisheries. Orr et al. (2013) reported that lights on offshore WTGs that flash intermittently do not present a continuous light source and are, thus, unlikely to disorient juvenile or adult sea turtles. Although the potential impacts of offshore lighting on juvenile and adult sea turtles are uncertain, WTG lighting is not anticipated to have any detectable impacts (adverse or beneficial) on any age class of sea turtles in the offshore environment. This reflects the research described above, as well as the lack of evidence of impacts on sea turtles from decades of operations on oil and gas platforms in the Gulf of Mexico, which may have considerably more lighting than offshore WTGs (BOEM 2019).

Therefore, lighting on offshore structures associated with planned offshore wind activities is not expected to have detectable effects on sea turtles and impacts would be negligible and any behavioral responses to offshore lighting are expected to be minor, localized, and temporary.

Noise: Ongoing and planned offshore wind activities that would generate anthropogenic noise are impact and vibratory pile driving, HRG surveys, detonations of UXO, vessel traffic, aircraft, cable laying or trenching, and turbine operation. These noise sources have the potential to affect sea turtles through behavioral or physiological effects.

The installation of WTG foundations into the seabed for ongoing and planned offshore wind projects involves pile driving and other construction activities that could cause underwater noise in the geographic analysis area and result in short-term behavioral disturbance and impacts on sea turtle hearing that may recover over time (i.e., TTS) as well as long-term impacts on sea turtle hearing (i.e., PTS). The potential for underwater noise to result in adverse impacts on a sea turtle depends on the received sound level and the frequency content of the sound relative to the hearing ability of the animal. The limited data available on sea turtle hearing abilities are summarized in Table 3.5.7-3. Sea turtles appear to hear frequencies from 30 Hz to 2 kilohertz, with a range of best hearing sensitivity between 100 and 700 Hz; however, there is some sensitivity to frequencies as low as 60 Hz and possibly as low as 30 Hz (Lavender et al. 2014; Bartol et al. 1999). Therefore, there is substantial overlap in the frequencies that sea turtles can detect and the dominant frequencies produced by offshore wind activities, including pile driving, impulsive sources used for HRG surveys, and UXO.

Table 3.5.7-3. Hearing capabilities of sea turtles

Species	Hearing Capabilities		Source
	Range (Hertz)	Highest Sensitivity (Hertz)	
	60–1,000	300–500	Ridgway et al. 1969

Species	Hearing Capabilities		Source
	Range (Hertz)	Highest Sensitivity (Hertz)	
Green Sea Turtle (*Chelonia mydas*)	100–800	600–700 (juveniles) 200–400 (subadults)	Bartol and Ketten 2006; Ketten and Bartol 2005
	50–1,600	50–400	Piniak et al. 2012a, 2016
Loggerhead Sea Turtle (*Caretta caretta*)	250–1,000	250	Bartol et al. 1999
	50–1,100	100–400	Martin et al. 2012; Lavender et al. 2014; Bartol et al. 1999
Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)	100–500	100–200	Bartol and Ketten 2006; Ketten and Bartol 2005
Leatherback Sea Turtle (*Dermochelys coriacea*)	50–1,600	100–400	Piniak et al. 2012b

Given the high energy levels of offshore wind energy survey and installation noise sources, it can be concluded that sea turtles would be affected by associated noise. There are limited data pertaining to behavioral responses of sea turtles and none specifically to sounds generated by offshore wind activities. Thresholds that have been established are presented in Table 3.5.7-4. McCauley et al. (2000) observed that one green sea turtle and one loggerhead sea turtle in an open water pen increased swimming behaviors in response to a single seismic airgun at received levels of 166 dB re 1 µPa and exhibited erratic behavior at received levels greater than 175 dB re 1 µPa. Moein et al. (1994) documented similar avoidance reactions to similar levels of seismic signals, although both studies were done in a caged environment, so the extent of avoidance could not be monitored. DeRuiter and Kamel (2012) observed that 57 percent of loggerhead sea turtles exhibited a diving response after seismic airgun array firing at received levels between 175 and 191 dB re 1 µPa. Moein et al. (1994) did observe a habituation effect to the airguns; the animals stopped responding to the signal after three presentations. Sea turtles can become habituated to repeated noise exposure over time and not suffer long-term consequences (O'Hara and Wilcox 1990). This type of noise habituation has been demonstrated even when the repeated exposures were separated by several days (Bartol and Bartol 2011; U.S. Navy 2018).

NMFS has adopted the U.S. Navy PTS and TTS thresholds for sea turtles as presented in Finneran et al. (2017). Table 3.5.7-4 outlines the acoustic thresholds for the onset of PTS, TTS, and behavioral disturbance for sea turtles for impulsive and non-impulsive noise sources. NMFS has considered behavioral response beginning at 175 dB re 1 µPa SPL_{RMS} (U.S. Navy 2017a). These thresholds apply to juvenile, subadult, and adult life stages.

Table 3.5.7-4. Sea turtle acoustic thresholds (dB) for impulsive and non-impulsive noise sources

Faunal Group	Injury - PTS			Impairment - TTS			Behavioral Disturbance L_p
	Impulsive L_{pk}	Impulsive L_E	Non-impulsive L_E	Impulsive L_{pk}	Impulsive L_E	Non-impulsive L_E	
Sea turtles	232	204	220	226	189	200	175

Sources: LGL 2024: Appendix A, Table 17; Limpert et al. 2024; Finneran et al. 2017; McCauley et al. 2000.

dB = decibels; PTS = permanent threshold shift; TTS= temporary threshold shift; L_{pk} = peak sound pressure level in decibels referenced to 1 microPascal squared; also written as SPL_{pk}; L_E = weighted cumulative sound exposure level in decibels referenced to 1 microPascal squared second; also written SEL_{cum}; L_p = root mean squared sound pressure level in decibels referenced to 1 microPascal squared; also written SPL_{rms} or L_{rms}.

In the planned activities scenario (Appendix D), the construction of 2,945 WTGs and OSPs would create underwater noise and may temporarily affect sea turtles if they are present in the ensonified area. While these potential effects are acknowledged, their potential significance is unclear.

Noise – pile driving: Impulsive noise from impact pile driving, due to the anticipated frequency and spatial extent of effects, represents the IPF with the highest likelihood for effects on individual sea turtles. Sea turtles exposed to impulsive noise with sound pressure levels that exceed 204 dB re 1 μPa^2 SEL_{cum} could experience PTS that could permanently limit an individual's ability to locate prey, detect predators, or find mates and could, therefore, have long-term effects on individual fitness. Sea turtles exposed to underwater sound pressure levels greater than 175 dB re 1 µPa SPL_{RMS} could experience behavioral disturbance (Finneran et al. 2017; McCauley et al. 2000). Such behavioral alterations could cause turtles to cease foraging or expend additional effort and energy avoiding the pile driving area. Presumably, sea turtles could continue foraging activities outside the area of elevated noise levels as adjacent habitat provides similar foraging opportunities. Although information is lacking, some sea turtles could, however, be temporarily displaced into areas that have a lower foraging quality or result in higher risk of interactions with ships or fishing gear. Sea turtles may experience physiological stress during this avoidance behavior, but it is anticipated that this stressed state would dissipate over time once the sea turtle is outside the ensonified area. This temporary displacement would result in a relatively small energetic consequence and would not be expected to have individual, population level, or long-term impacts on sea turtles.

Planned offshore wind activities may also use vibratory pile driving as an alternative to impact pile driving. Vibratory pile driving is considered a non-impulsive continuous sound source and would transmit sound in the water column for a longer period of time than with impact pile driving. Source levels for vibratory pile driving, expressed as SEL, have been measured between 175 to 190 dB re 1 $\mu Pa^2 m^2 s$ (Hart Crowser et al. 2009), which are below the threshold associated with potential hearing injury in sea turtles (Finneran et al. 2017). Vibratory pile-driving noise can exceed levels associated with behavioral disturbances in sea turtles but only within short distances from the source (Denes et al. 2018). Given this low exposure probability, vibratory pile-driving noise impacts on sea turtles would be negligible at the individual and population levels.

Potential impacts on sea turtles from multiple construction activities in the same calendar year could affect migration, feeding, breeding, and individual fitness. Intermittent, long-term impacts may be high-intensity and result in a high-exposure level. The magnitude of these impacts would be dependent upon the locations of concurrent construction operations, as well as the number of hours per day, the number of days that pile driving would occur, and the time of year in which pile driving occurs. Individuals repeatedly exposed to pile driving over a season, year, or life stage may incur energetic costs that have the potential to lead to long-term consequences (U.S. Navy 2018). However, individuals may become habituated to repeated exposures over time and ignore a stimulus that was not accompanied by an overt threat (Hazel et al. 2007); individuals have been shown to retain this habituation even when the repeated exposures were separated by several days (Bartol and Bartol 2011; U.S. Navy 2018). Therefore, impacts on sea turtles from impact pile driving would be minor, as only short-term, low-intensity behavioral responses are expected that would not result in population-level impacts.

Noise from pile driving may also occur periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. Noise transmitted through water or through the seabed can result in high-intensity, low-exposure-level, and long-term but localized intermittent risk to sea turtles.

Noise – G&G (HRG surveys and geotechnical drilling activities): In the geographic analysis area, ongoing activities that may produce noise would include site characterization surveys and scientific surveys (i.e., HRG surveys). These would be infrequent and produce high-intensity impulsive noise that has the potential to affect sea turtles, including potential auditory injuries and behavioral responses, which could include short-term displacement of feeding or migrating (NSF and USGS 2011). The potential for PTS and TTS in sea turtles is considered possible if these animals were to occur near the HRG survey noise source.

Offshore wind energy projects perform geological and geophysical surveys, including HRG surveys that use a combination of sonar-based methods to map shallow geophysical features and can be classified as impulsive or non-impulsive noise sources. The equipment is towed behind a moving survey vessel and generates a short-duration pulse in the 1.1 to 200 kilohertz (kHz) range, with the interval between pulses ranging from 0.2 to 1 second, depending on the specific type of equipment used. The equipment only operates when the vessel is moving along a survey transect, meaning that the ensonified area is intermittent and constantly moving. HRG surveys that use non-impulsive sources are not expected to affect sea turtles because they operate at frequencies above the sea turtle hearing range (e.g., multibeam echosounders, side scan sonar). BOEM (2018) and NMFS (2021a) evaluated potential underwater noise effects on sea turtles from HRG surveys using impulsive sources (boomers/airguns/sparkers/sub-bottom profilers) and concluded that for an individual sea turtle to experience PTS (204 dB re 1 $\mu Pa^2 s$ SEL_{cum}; 232 dB re 1 $\mu Pa^2 \cdot s$ SPL [0–pk] impulsive sources), it would have to be within 3.3 feet (1 meter) of the loudest possible noise source. In fact, NMFS (2021a) states that none of the equipment being operated for HRG surveys—with frequencies that overlap with sea turtles' hearing—has source levels loud enough to result in PTS or TTS. However, noise from impulsive sources used during HRG surveys could exceed the behavioral effects threshold (175 dB) up to 90 meters from the source, depending on the type of equipment used. Given the limited extent of potential noise effects, injury-level exposures (PTS/TTS) are unlikely to occur. As stated above and based on the loudest impulsive noise source, it is highly unlikely that noise from HRG survey sound sources would cause PTS or TTS in sea turtles (NMFS 2021). While low-level behavioral exposures could occur, these disruptions would be limited in extent and short term in duration given the movement of the survey vessel and the mobility of the animals. Therefore, underwater noise impacts from HRG surveys are expected to be minor.

Noise – site preparation: Noise from infrequent trenching activities for pipeline and cable laying, as well as other cable burial, dredging, and marine minerals extraction, could cause behavioral disturbance to sea turtles, which is expected to be localized and temporary. During planned offshore wind projects, noise-producing activities associated with cable laying include route identification surveys, trenching, jet plowing, backfilling, and cable protection installation. Modeling based on noise data collected during cable laying operation in Europe estimates that underwater noise levels would exceed 120 dB in a 98,842-acre area surrounding the source (Bald et al. 2015; Nedwell and Howell 2004; Taormina et al. 2018). As the cable-laying vessel and equipment would be continually moving, the ensonified area would also move. Given the dynamic nature of the ensonified area, a given location would not be ensonified for more than a few hours. Therefore, impacts from cable-laying noise would result in negligible adverse effects on sea turtles.

Noise – turbine operation: Operating WTGs generate non-impulsive underwater noise that is audible to sea turtles. Operational sound is generated by WTGs due to pressure differentials across the airfoils of moving turbine blades and from mechanical noise of bearings and the generator converting kinetic energy to electricity. Sound generated by the airfoils, like aircraft, is produced in the air and enters the water through the air-water interface. Mechanical noise associated with the operating WTG is transmitted into the water as vibration through the foundation and subsea cable. Both airfoil sound and mechanical vibration may result in long-term, continuous noise in the offshore environment. Measured underwater sound levels in the literature are limited to geared smaller wind turbines (less than 6.15 MW), as summarized by Tougaard et al. (2020). Tougaard et al. 2009 measured SPLs ranging between 109 and 127 dB re 1 µPa underwater 45 and 65 feet (14 and 20 meters) from the foundations at frequencies below 315 Hz up to 500 Hz. Wind turbine acoustic signals above ambient background noise were detected up to 2,066 feet (630 meters) from the source (Tougaard et al. 2009). Noise levels were shown to increase with higher wind speeds (Tougaard et al. 2009). Operational noise from larger, current-generation WTGs on the order of 10 MW would generate higher source levels than the range noted above and were modeled up to 170 dB re 1 µPa SPL_{RMS} (Stöber and Thomsen 2021). However, the shift from using gear boxes to direct-drive technology is expected to reduce the sound level by around 10 dB and, based on available data, the sound levels produced during the operation of planned offshore wind projects would be less than the injurious thresholds defined by NMFS for sea turtles. At Block Island Wind Farm, turbine noise of 6 MW turbines reached ambient noise levels within 164 feet (50 meters) of the turbine foundations (Miller and Potty 2017); so while sound may cause behavioral effects, these effects are expected to be at relatively short distances from the foundations (Miller and Potty 2017; Tougaard et al. 2009). Additionally, studies suggest that sea turtles acclimate to repetitive underwater noise in the absence of an accompanying threat (Bartol and Bartol 2011; Hazel et al. 2007; U.S. Navy 2018). Underwater noise from offshore wind project operation is unlikely to result in significant effects on the forage base for sea turtles. These species are primarily invertivores or, in the case of green sea turtles, omnivorous vegetarians. The sound sensitivity of invertebrates like crabs, jellyfish, and mollusks is restricted to particle motion and the effect dissipates rapidly such that any effects are highly localized to the immediate proximity (i.e., on the order of meters) of the noise source (Edmonds et al. 2016). Although loggerhead and Kemp's ridley sea turtles may periodically prey on fish, fish represent a minor component of a flexible and adaptable diet. Underwater noise could temporarily reduce the availability of fish prey species, but these effects would be limited in extent and duration. Therefore, noise impacts on sea turtles are expected to be negligible from operating WTGs.

Noise – UXO detonation: Offshore wind activities may encounter UXO on the seabed in the lease areas or along export cable routes. While non-explosive methods may be employed to lift and move these objects, some may need to be removed by explosive detonation. Underwater explosions of this type generate high pressure levels that could cause disturbance and injury to sea turtles, but the number of affected individuals would be small relative to the population sizes. The number and location of detonations that may be required for offshore wind projects are relatively unknown. Impacts associated with UXO detonations for other projects would result in minor impacts and would be similar to those described for the Proposed Action in Section 3.5.7.5, *Impacts of Alternative B – Proposed Action on Sea Turtles*.

Noise – vessel and aircraft: Due to the large number of vessels required for planned offshore wind development, vessel noise could potentially result in impacts to individual sea turtles. Vessels generate low-frequency (10 to 100 Hz) (MMS 2007), non-impulsive noise that overlaps with the hearing range of sea turtles and may elicit behavioral responses such as temporary startle responses, masking of biologically relevant sounds, physiological stress, and behavioral changes, especially in their submergence patterns (NSF and USGS 2011; Samuel et al. 2005). However, Hazel et al. (2007) suggest that sea turtles' ability to detect approaching vessels is primarily vision-dependent, not acoustic. The increase in vessel activity associated with planned offshore wind activities could cause repeated, intermittent impacts on sea turtles resulting from short-term, localized behavioral responses, which would dissipate once the vessel leaves the area. BOEM considers these temporary behavioral effects to be unlikely given the patchy distribution of sea turtles in the geographic analysis area, and, therefore, minor impacts with no stock or population-level effects would be expected.

Helicopters may be used to transport crew during construction or operation of offshore wind facilities. When aircraft travel at relatively low altitude, non-impulsive aircraft noise has the potential to elicit stress or behavioral responses (e.g., diving or swimming away or altered dive patterns) (BOEM 2017; NSF and USGS 2011; Samuel et al. 2005). Helicopters transiting to offshore wind facilities are expected to fly at sufficient altitudes to avoid behavioral effects on sea turtles, with the exception of WTG inspections, take-off, and landing. Any behavioral responses elicited during low-altitude flight would be minor and temporary, dissipating once the aircraft leaves the area; these responses are not expected to be biologically significant.

Noise summary: Impacts of noise on sea turtles from construction and operation of offshore wind projects have been previously analyzed and could range from negligible to moderate during construction and would be negligible during operation. Moderate impacts could result from impact pile driving during construction; however, low numbers of sea turtles are expected to be present and population-level effects are unlikely, which reduces the potential adverse impact level to minor. WTG operation noise could result in localized behavioral effects (BOEM 2021a, 2021b) but are likely to be negligible. Based on the above discussion, BOEM anticipates that the impacts of noise on sea turtles from planned offshore wind activities would be minor and is anticipated to be localized, infrequent, and temporary.

Port utilization: Offshore wind on the Atlantic OCS may require the expansion or improvement of regional ports to support planned projects. The increased size of vessels and increased volume of vessel traffic may necessitate expansion. Increased port utilization and expansion results in increased noise associated with vessels or pile driving for port expansion and increased suspended sediment concentrations during port expansion activities, including dredging and pile driving. The impacts of vessel noise on sea turtles are expected to be short term and localized. Impacts on water quality associated with increased suspended sediment would also be temporary and localized. Additionally, the area affected by benthic disturbance would be small compared to available foraging habitat. Any future port expansion and associated increase in vessel traffic would be subject to an independent NEPA analysis and regulatory approvals requiring full consideration of potential effects on sea turtles regionwide.

Increased port utilization may require dredging at ports or within navigation channels to accommodate the large ships required to carry WTG components. In addition to benthic disturbance and increased suspended sediment concentrations, dredging can affect sea turtles through impingement, entrainment, or capture in the dredges, as described previously. These impacts would be localized to nearshore habitats, and typical mitigation measures (e.g., timing restrictions) are expected to minimize risk to sea turtles. Therefore, risks of injury or mortality are considered low and population-level effects are unlikely to occur.

Based on the discussion above, the impacts of port utilization on sea turtles from planned offshore wind activities would likely be minor because the potentially affected habitats would be small relative to the habitat used by sea turtles in the geographic analysis area.

Presence of structures: The development of offshore wind projects in the planned activities scenario would install more buoys, meteorological towers, foundations, and hard protection. Up to 3,025 WTG and 55 OSP foundations with associated scour protection could be built in the geographic analysis area. These structures would occupy open-water, pelagic habitat and would provide presently unavailable hard structure within the water column. The presence of structures could result in hydrodynamic changes; obstructions that cause loss of fish gear resulting in entanglement or ingestion by sea turtles; habitat conversion from open-water pelagic and benthic soft substrates to structurally complex, mid-water and benthic hard bottom; new areas of prey aggregation; avoidance or displacement; and behavioral disruption.

The addition of new hard surfaces and structures, including WTG foundations, scour protection, and hard protection on top of cables, to a mostly sandy seafloor would create a more complex habitat. The structures would create an artificial reef effect, whereby more sessile and benthic organisms would likely colonize the structures over time (e.g., sponges, algae, mussels, shellfish, sea anemones). Higher densities of filter feeders, such as mussels that colonize the structure surfaces, could consume much of the increased primary productivity but also provide a food source and habitat to crustaceans such as crabs (Dannheim et al. 2020). Growth around the artificial reefs may provide food for sea turtles. Loggerhead sea turtles are benthic foragers, feeding on vegetation, crabs, mollusks, jellyfish, fish, and other invertebrates that would grow on the artificial reef (Dodd 1988; Seney and Musick 2007). Mollusks and crabs are primary food items for juvenile loggerheads, raising the possibility of the artificial reefs being a foraging area for young sea turtles (Burke et al. 1994). Structure-oriented finfish species such as black sea bass, striped bass, and Atlantic cod would be attracted to these more complex structures. Among the fish attracted to the structure would be sea turtle predators, such as sharks, increasing the likelihood of sea turtle predation. These impacts would likely be permanent or remain as long as the structure remains.

The presence of in-water structures could alter local hydrodynamic patterns at a fine scale downstream of the structures (refer to Section 3.4.2, *Water Quality*, and Section 3.5.6, *Marine Mammals* for additional discussion). Water flows are reduced immediately downstream of foundations but return to ambient levels within a relatively short distance (Miles et al. 2017). The downstream area affected by reduced flows is dependent on pile diameter. For monopiles (i.e., the structures with the largest diameter), the downstream effects are expected at a distance of 100 meters to 1 kilometer of the structures (Dorrell et al. 2022). Although effects from individual structures are highly localized, the presence of all structures associated with ongoing and planned offshore wind activities in the geographic analysis area could result in regional impacts on wind wave energy, mixing regimes, and upwelling (van Berkel et al. 2020). Nantucket Shoals functions as a foraging area for marine vertebrates because of the presence of tidally driven currents and a persistent frontal zone mixing the water and increasing productivity; therefore, localized and regional alterations to hydrodynamics could have impacts on productivity and sea turtle prey species. Fine-scale effects on water flow could have localized impacts on prey distribution and abundance. Regional hydrodynamic effects could impact prey species at a broader scale. Effects on surface currents could influence patterns of larval distribution (Johnson et al. 2021) and seasonal mixing regimes could influence primary productivity, both of which could, in turn, affect the distribution of fish and invertebrates on the OCS (Chen et al. 2018; Lentz 2017). Hydrodynamic alterations due to the presence of WTGs could increase primary productivity in the vicinity of the structures (Carpenter et al. 2016; Schultze et al. 2020). However, such an increase would be highly localized, and the increased productivity may be consumed by filter feeders colonizing the structures (Slavik et al. 2019) rather than leading to increased prey abundance for sea turtles.

The presence of WTG vertical structures such as towers and foundations in the pelagic environment may affect the flow of water within and near the Lease Area. The general understanding of offshore wind–related impacts on hydrodynamics is derived primarily from European based studies. A synthesis of European studies by van Berkel et al. (2020) summarized the potential effects of wind turbines on hydrodynamics and fisheries. Local to a wind facility, the range of potential impacts include increased turbulence downstream, remobilization of sediments, reduced flow inside wind farms, downstream changes in stratification, redistribution of water temperature, and changes in nutrient upwelling and primary productivity. Modeling studies on the wind facility-induced effects on mixing and stratification depend on a number of factors including turbine size and orientation, number of wind turbines, local atmospheric and oceanographic conditions, and model input parameters (Miles et al. 2021). While model simulations in European wind farms have shown changes to mixing and stratification downstream of pilings and a potential for cascading ecological effects, discerning the wind facility-induced effect signal from location-specific natural variability in environmental conditions can be challenging

(Carpenter et al. 2016; Floeter et al. 2017; Schultze et al. 2020). As environmental conditions in the northeastern U.S. shelf differ from European wind farm sites in the North Sea (e.g., seasonal stratification), more research is needed to identify the magnitude and type impact offshore wind farms will have on ocean processes specific to the U.S. Atlantic OCS (Hogan et al. 2023).

Net primary productivity is driven by photosynthesis in marine phytoplankton and accounts for half of global-scale photosynthesis and supporting major ocean ecosystem services (Field et al. 1998). There are few empirical data showing the impact of WTGs on ocean stratification (Tagliabue et al. 2021), although recent models have demonstrated ocean mixing as a result of the wind-wake effect of WTGs in the North Sea (Carpenter et al. 2016; Floeter et al. 2017, Dorrell et al. 2022; Christiansen et al. 2022; Daewel et al. 2022). However, interannual changes in net primary productivity in the North Atlantic are poorly correlated with parallel changes to stratification. Tagliabue et al. (2021) emphasizes the importance of other physical mechanisms, especially the Gulf Stream. Potential impacts on net primary productivity in the North Atlantic from offshore wind projects may occur, however, in the absence of additional data, these impacts are considered negligible when compared with the effects of the Gulf Stream.

A modeling study of atmospheric wake effects by Daewel et al. (2022) showed that extremely large clusters of offshore wind turbines (24,000 5-MW WTGs with a 295-foot [90-meter] hub height) in the North Sea provoke large scale changes in annual primary productivity. Productivity was modeled to decrease in the center of large wind farm clusters but increased around these clusters in the shallow, near-coastal areas of the inner German Bight and Dogger Bank. These modeled changes in net primary production were found to reach up to 10 percent locally but remained below 1 percent both inside and outside of the offshore wind farm clusters when integrated over a larger scale. As a result of reduced average current velocities, model results also showed a reduction in bottom-shear stress leading to reduced resuspension of organic carbon, increased amounts of organic carbon in sediments, and changes to bottom water oxygen concentrations. While more pronounced locally compared to the region-wide average, changes in sedimentation, seabed processes, and spatial distribution of primary production have the potential to impact higher trophic levels and ecosystem function. The authors indicate the need for more research to assess the combined effects of atmospheric wakes and turbulent wakes induced by wind turbine foundations as the latter might counteract the stabilizing effect of the wind wakes (Daewel et al. 2022). These model results reflect a buildout of turbines that is almost 8 times the approximately 3,100 WTGs currently expected to be installed for all wind farms on the East Coast from Massachusetts to North Carolina. While detectable changes to the atmospheric forces that affect sea surface mixing are likely to occur once wind farms on the Atlantic OCS become operational, the potential influence that these impacts will have on biological productivity remains uncertain given the different physical factors in the geographic analysis area than were modeled, the much lower number of wind turbines, and the larger size of wind turbines (2 to 3 times larger) planned for the Atlantic OCS compared to those modeled by Daewel et al. (2022).

In a modeling study focused on the buildout of larger-sized WTGs (up to 15 MW and 150-meter hub height) on the U.S. northeast shelf, on average, meteorological changes at the surface induced by next-generation extreme-scale offshore wind turbines (diameter and hub height greater than 492 and 328 feet [150 and 100 meters], respectively) will be nearly imperceptible (Golbazi et al. 2022). The authors simulated the potential changes to near-surface atmospheric properties caused by large offshore wind facilities in the summer and found significant wind speed reduction at hub height within the wind farm (up to 2 meters per second or a 20 percent reduction) that decreased with downwind distance from the wind farm. However, at the surface, an average wind speed deficit of 0.5 meter per second or less (10 percent maximum reduction) was found to occur within the wind farm footprint along with a slight cooling effect (-0.06 Kelvin on average). In comparison, studies on the effects of WTG wind wakes in the North Sea have identified the reduction in wind-induced mixing as the catalyst to changes in upper ocean dynamics (Ludewig 2015; Christiansen et al. 2022) and biological productivity (Daewel et al. 2022). Given the lower wind speed reductions (10-20 percent) reported by Golbazi et al. (2022) for the larger wind turbines planned for the U.S. Atlantic OCS compared to a wind speed reduction of up to 43-percent for smaller turbines in the North Sea (Platis et al. 2020), it is plausible that the observed effects from the reduction in wind-induced mixing would also be lessened. However, more region-specific research is still needed to validate this assumption.

Wind wake may also disturb planktonic transport, and thus, prey availability for sea turtles (van Berkel et al. 2020). The National Academies of Science Engineering and Medicine recently evaluated the potential of offshore wind farms to alter the hydrodynamic processes that impact plankton abundance and availability in the Nantucket Shoals region (NASEM 2024). The study concluded that impacts of offshore wind projects on prey availability will likely be difficult to distinguish from the significant impacts of climate change and other influences on the ecosystem. Further monitoring studies will be needed to have the spatial and temporal coverage to adequately understand the impact of future wind farms.

Oceanographic and hydrodynamic conditions resulting from the presence of offshore structures are not fully understood at this time but may conservatively range from hundreds of meters (Li et al. 2014; Schultze et al. 2020) to tens of kilometers (Dorrell et al. 2022; Christiansen et al. 2022) and likely to vary seasonally and regionally. These impacts would likely be permanent but variable, and because of the relatively low offshore wind blocking effect, impacts would be expected to be minor when compared to natural variability (Floeter et al. 2017). Since the leatherback sea turtle is the most pelagic of the turtles, it is expected to be the most affected by hydrodynamic effects from offshore wind structures. The leatherback sea turtle primarily feeds on planktonic jellyfish. Alterations in the hydrodynamic environment would have the potential to alter spatial distributions of jellyfish aggregations which Leatherback sea turtles are known to follow (Bailey et al. 2012). Thus, the presence of WTGs in the Offshore Project area may influence the distribution of jellyfish prey and, in turn, affect the distribution of leatherback sea turtles.

In the Gulf of Mexico, loggerhead, leatherback, green, Kemp’s ridley, and hawksbill sea turtles have been documented in the vicinity of offshore oil and gas platforms, with the probability of occupation increasing with the age of the structures (Gitschlag and Herczeg 1994; Hastings et al. 1976). Sea turtles would be expected to use habitat in between the WTGs and around structures for feeding, breeding, resting, and migrating for short periods, but residency times around structures may increase with the age of structures if communities develop on and around foundations. Project-specific effects would vary, recognizing that larger and contiguous projects could have more significant effects on prey and forage resources, but the extent and significance of these effects cannot be predicted based on currently available information.

While the anticipated reef effect may result in long-term beneficial impacts on sea turtles, some potential exists for increased exposure to fishing gear that could lead to entanglement, ingestion, injury, and death. The presence of structures may concentrate recreational fishing around foundations and would also increase the risk of gear loss or damage. This could cause entanglement, especially with monofilament line, and increase the potential for entanglement in both lines and nets leading to injury and mortality due to abrasions, loss of limbs, and increased drag, resulting in reduced foraging efficiency and ability to avoid predators (Barnette 2017; Berreiros and Raykov 2014; Foley et al. 2008). The reef effect may attract recreational fishing effort from inshore areas and attract sea turtles for foraging opportunities, resulting in a small increase in risk of entanglement and hooking or ingestion of marine debris where fishers and turtles are concentrated around the same foundations.

After construction is complete, structures in WEAs would enter the O&M during which routine maintenance of structures would be required and conducted by maintenance crews. The deployment of maintenance crews would involve an increase of traffic in the WEA in the form of crew transport vessels and any required equipment vessels (such as jack-up vessels). Lighting would also be activated during crew transfers and maintenance. During standard operation, WTGs would not use continuous lighting, and instead they would use an ADLS, which would activate the lighting system based on approaching air traffic. Operation of structures in WEAs would entail operational noise, which is discussed under the *Noise* IPF. Non-noise-related operational activities would be temporary and localized to the individual structures undergoing maintenance.

Given the available information, the risk of injury to or mortality of individual sea turtles due to the presence of structures planned offshore wind activities, and the interactions with fishing gear that they may cause, would be minor and population-level effects are unlikely to occur. Likewise, any beneficial impacts from the reef effect would be minor, as individuals may benefit but there would be no population-level effects.

Traffic: Planned offshore wind activities would result in increased vessel traffic due to vessels transiting to and from individual lease areas during construction, operation, and decommissioning. Vessel strikes are an increasing concern for sea turtles. The percentage of stranded loggerhead sea turtles with injuries that were apparently caused by vessel strikes increased from approximately 10 percent in the 1980s to over 20 percent in 2004, although some stranded turtles may have been struck post-mortem (NMFS and USFWS 2007b). Sea turtles, with the exception of hatchlings and pre-recruitment juveniles, spend a majority of their time submerged, during which time they may not be susceptible to vessel strikes. Sea turtles spend less than 6 percent of their time at the water’s surface (Lutcavage and Lutz 1997), during which they would be most vulnerable to being struck by vessels or propellers. Information on swim depth is provided in the U.S. Navy Undersea Warfare Center’s dive distribution and group size parameter reports (Watwood and Buonantony 2012; Borcuk et al. 2017); these data suggest that loggerhead and green sea turtles spend 60 to 75 percent of the time within 32 feet (10 meters) of the surface, leatherback sea turtles spend about 20 percent of the time within 32 feet (10 meters) of the water surface, and there are insufficient data to quantify Kemp's ridley sea turtle activity. Any sea turtle found in the geographic analysis area could thus occur at or near the surface, whether resting, feeding, or periodically surfacing to breathe.

Construction of each individual offshore wind project would generate approximately 15 to 35 simultaneous construction vessels at any given time (BOEM made a conservative assumption that construction vessel traffic for other offshore wind projects would be similar to the Proposed Action; refer to Section 3.6.6, *Navigation and Vessel Traffic,* for additional information regarding vessel traffic). Combined, the other offshore wind projects in the geographic analysis area would generate approximately 36 vessels per day during normal O&M beginning in 2030. This vessel traffic increase would be expected to result in a small incremental increase in overall vessel traffic in the geographic analysis area for sea turtles. The relative risk of vessel strikes from wind industry vessels would depend on the stage of development, time of year, number of vessels, and speed of vessels during each stage. Offshore wind projects may also cause shifts in vessel traffic, including temporary restrictions of fishing vessels during project construction due to the implementation of safety zones, potential increases in vessel traffic in the offshore wind lease areas after project construction due to an influx of recreational fishing vessels targeting species associated with an artificial reef effect, and likely shifts in commercial fishing vessels from the wind energy lease areas to areas not routinely fished due to recreational vessel congestion and gear conflict concerns.

Collision risk is expected to be greatest when offshore wind vessels transit between the offshore wind lease areas and ports utilized by each project, as vessel speeds would be highest and turtles are expected to be most susceptible to strike in coastal foraging areas. Vessel speed may exceed 10 knots (18.5 kilometers per hour) in such waters, and those vessels traveling at speeds greater than 2 knots (4 kilometers per hour) would pose the greatest threat to sea turtles, as the turtles cannot reliably avoid vessels moving faster than 2 knots (4 kilometers per hour) (Hazel et al. 2007). The risk would be greatest for species with the highest densities in a given project area. The increased risk of vessel strikes has the potential to result in injury or mortality to individual sea turtles but would not be expected to have stock or population-level impacts on sea turtles given their low densities in the geographic analysis area and patchy distribution. Additionally, BOEM expects minimization measures for vessel impacts would be required for planned offshore wind activities, further reducing the risk of injury or mortality for sea turtles, resulting in overall minor impacts.

Conclusions

Impacts of the No Action Alternative: Under the No Action Alternative, sea turtles would continue to follow current regional trends and respond to current and future environmental and societal activities. BOEM expects ongoing activities would have temporary to permanent impacts on sea turtles (disturbance, displacement, injury, mortality, and reduced foraging success), primarily due to lighting associated with coastal development, noise, marine pollution, vessel strikes, entanglement or ingestion of fishing gear, and ongoing climate change. The No Action Alternative, including ongoing non-offshore wind and offshore wind activities, would result in **minor adverse** impacts on sea turtles because impacts on sea turtles would be detectable and measurable but of low intensity, localized, and temporary or short term in duration.

Cumulative Impacts of the No Action Alternative: BOEM expects that ongoing and planned activities would result in continuing localized and temporary to permanent impacts on sea turtles. Intermittent, temporary impacts from underwater noise may be of high intensity and result in a high exposure level but impacts on sea turtles are not expected to result in population-level effects. Although there would be a loss of existing benthic habitat, WTG and OSP foundations may provide foraging and sheltering opportunities for sea turtles. The significance of this reef effect is unknown, however, and is not expected to result in biologically significant impacts on sea turtles, resulting in negligible beneficial impacts. BOEM anticipates that the No Action Alternative combined with all ongoing and planned activities (including other offshore wind activities) would result in **minor adverse** impacts, because potential impacts may include injury or loss of individuals, but these impacts would not result in population-level effects.

3.5.7.4 Relevant Design Parameters and Potential Variances in Impacts

This EIS analyzes the maximum-case scenario; any potential variances in the proposed Project build-out as defined in the PDE would result in impacts similar to or less than those described in the sections below. The following PDE parameters (Appendix C, *Project Design Envelope and Maximum-Case Scenario*) would influence the magnitude of the impacts on sea turtles:

- Noise associated with the construction, operation, and decommissioning of Project structures (e.g., pile driving and construction vessels), which could have behavioral and physiological effects, or cause auditory injury to sea turtles.
- Vessel traffic, which could increase collision risk to sea turtles due to vessels transiting to and from the Wind Farm Area during construction, operations, and decommissioning, and increased recreational fishing vessels.
- The presence of structures, which could cause both beneficial and adverse impacts on sea turtles through localized changes to hydrodynamic disturbance, prey aggregation and associated increase in foraging opportunities, incidental hooking from recreational fishing around foundations, entanglement in lost and discarded fishing gear, migration disturbances, and displacement.

Variability of the proposed Project design exists as outlined in Appendix C. The following is a summary of potential variances in impacts.

- Foundation type: The potential acoustic impacts on sea turtles differ among the foundation types that the Proposed Action would use, which is up to 5 OSPs and up to 147 WTGs with monopile, piled-jacket, or suction-bucket-jacket foundations. Construction of the jacket-type foundation would have a higher acoustic impact than construction of the monopile foundation due to the increased risk of exposure because of the longer time required to install more piles (up to four 14.7-foot [4.5-meter] pin piles per jacket). Benthic impacts that also impact prey availability to sea turtles may also vary depending on the foundation types used.

- Monopile diameter: The potential acoustic impacts on sea turtles differ among the WTG monopile diameters that may be used. SouthCoast Wind would use monopiles with a maximum diameter of 52.5 feet (16.0 meters).
- WTG number: All potential impacts would be lessened with a decrease in number of WTGs built.
- OSP/HVDC converter stations: The number and type of OSP foundations will change the number of legs per OSP foundation entanglement impacts from cross beams, and impingement/entrainment risk and thermal plume effects from a CWIS.
- Season of construction: The active season for sea turtles in New England waters is from May through November. Construction outside of this window would have fewer impacts on sea turtles than construction during the active season.

Although some variation is expected in the design parameters, the impact assessment on sea turtles in this section analyzes the maximum-case scenario.

SouthCoast Wind has committed to measures to minimize impacts on sea turtles, which are considered part of the Proposed Action and applicable action alternatives and are assessed within each IPF. These applicant-proposed AMMs include, but are not limited to, incorporating soft start methods during initial pile-driving activities to allow sea turtles to migrate away from the area of effect, employing sound-attenuation methods, ensuring that all vessels underway do not intentionally approach any sighted sea turtle, and ensuring that all vessels maintain a separation distance of 164 feet (50 meters) or greater from any sighted sea turtles (COP Volume 2, Table 16-1; SouthCoast Wind 2024).

As part of its COP, SouthCoast Wind has also developed a Marine Mammal and Sea Turtle Monitoring and Mitigation Plan for ESA-listed sea turtle species (COP Volume 2, Appendix O; SouthCoast Wind 2024). Measures proposed include but are not limited to protected species observers, vessel avoidance measures such as separation distances and speed restrictions, pile driving time-of-year restrictions, visual monitoring for HRG surveys, UXO detonation monitoring, marine debris awareness training, and monitoring and reporting of sea turtle observations during activities with potential impacts. Some of these mitigation measures will have limited effectiveness since visual observations during vessel transits will be difficult due to the significant time sea turtles spend at or just below the surface. Appendix G, Table G-1 provides a full list of the committed measures in greater detail.

3.5.7.5 Impacts of Alternative B – Proposed Action on Sea Turtles

This section summarizes the potential impacts of the Proposed Action on sea turtles during the various phases of the proposed Project. Routine activities would include construction, O&M, and decommissioning of the proposed Project, as described in Chapter 2, *Alternatives*.

The analysis of impacts under the No Action Alternative, and references therein, applies to the following discussion of the Proposed Action. The most impactful IPFs associated with the Proposed Action are discussed below and include underwater noise during pile driving, which could cause temporary impacts; increased vessel traffic, which could lead to injury or mortality from vessel strikes; the presence of structures, which would lead to permanent impacts that may be either adverse or beneficial; and cable emplacement and maintenance, which could affect sea turtles from mechanical and hydraulic dredging techniques and via water quality effects.

Accidental releases: As discussed in Section 3.5.7.3, *Impacts of Alternative A – No Action on Sea Turtles*, accidental release of trash and debris may occur from Project vessels during construction, operations, and decommissioning. BOEM assumes operator compliance with federal and international requirements for managing shipboard trash; such events also have a relatively limited spatial impact. While precautions to prevent accidental releases would be employed by vessels and port operations associated with the Project, it is likely that some debris could be lost overboard during construction, maintenance, and routine vessel activities. However, the amount would likely be miniscule compared to other inputs. In the event of a release, it would be an accidental, localized event in the vicinity of the Project area, likely resulting in non-measurable impacts, if any. However, because sea turtle ingestion of trash can be fatal, the overall impact would be minor.

Accidental releases can have both physical and chemical effects on sea turtles that negatively influence the health and survival of affected individuals (Shigenaka et al. 2021). The risk of any type of accidental release would be increased, primarily during construction, but also during O&M and decommissioning of offshore wind facilities. Table 3.5.7-5 outlines the amounts of oils and chemical fluids that represent potential accidental releases. In the event of a release, it would be an accidental, localized event in the vicinity of the Project area, likely resulting in non-measurable impacts. To reduce any impacts to sea turtles from accidental releases, SouthCoast Wind has developed an OSRP (COP Appendix AA; SouthCoast Wind 2024) with measures to avoid accidental releases and a protocol to respond to such a release if one occurs. SouthCoast Wind will adhere to all regulations under the USEPA Clean Water Act and has proposed mitigations measures (Appendix G, Table G-1). SouthCoast Wind will ensure that the shortest line length, rubber sleeves, and weak links will be used on mooring systems to prevent lines from looping or wrapping around ESA-listed species, while ensuring the safety and integrity of the structure or device (Appendix G, Table G-1). Therefore, accidental releases are considered unlikely.

Table 3.5.7-5. Total gallons of coolant, oils, lubricants, and diesel fuel in the Project area

Fluid Type	Gallons
Total Coolant Fluids in WTGs	73,500
Total Coolant Fluids in OSP or ESP	1,500
Total Oils and Lubricants in WTGs	433,650
Total Oils and Lubricants in OSP or ESP	755,000
Total Diesel Fuel in WTGs	132,300
Total Diesel Fuel in OSP or ESP	200,000

Source: Appendix D, Table D2-3.

The incremental impacts of the Proposed Action would not increase the risk of accidental releases beyond that described under the No Action Alternative. Potential impacts on sea turtles from exposure to accidental releases are expected to be sublethal due to quick dispersion, evaporation, and emulsification, which would limit the amount and duration of exposure and would have a negligible impact.

Cable emplacement and maintenance: The Proposed Action would entail a maximum of approximately 1,676 miles (2,697 kilometers) of cables, which includes 497 miles (800 kilometers) of interarray cables and 1,179 miles (1,897 kilometers) of offshore export cables. SouthCoast Wind would bury export cables to a depth of 3.2 to 13.1 feet (1 to 4 meters) below the surface and interarray cables to a depth of 3.2 to 8.2 feet (1 to 2.5 meters) below the surface. Impacts (disturbance, displacement, injury, and mortality) of new cable emplacement and maintenance under the Proposed Action are estimated to affect up to 2,480 acres (10.6 km^2) of seafloor in the export cable route corridors and 1,408 acres (5.7 km^2) in the Lease Area. The majority of benthic sediments in the Offshore Project area are fine sediments as described in Section 3.5.2.1, and any benthic invertebrate prey species of sea turtles would recover quickly and are not expected to have population-level impacts due to the small construction footprint compared to the geographic analysis area. Over 90 percent of the Brayton Point ECC benthic samples and 90 percent of the southern Falmouth ECC benthic samples are sand or finer, with only one sample of complex habitat occurring in the Lease Area. [1] Seafloor disturbances during installation and maintenance of interarray and offshore export cables may cause temporary behavioral changes in foraging activities of sea turtles in the Project area. Avoidance of the disturbed area due to a decline in foraging quality may occur for Kemp's ridley and loggerhead sea turtles because their preferred prey species include bottom-dwelling crustaceans and mollusks, which would be directly affected during cable installation. Leatherback sea turtles mainly feed on jellyfish and salps that occur in the water column and are unlikely to be impacted by cable emplacement, thus, impacts to leatherback sea turtle prey availability is expected to be negligible. Some areas where cables cannot be buried would be hard bottom habitats; thus, the addition of cable protection would not remarkably change the sediment type or alter sea turtle prey resources.

Dredging may be used for cable installation in areas for sand wave clearance to ensure cable burial below mobile seabed sediments and for HDD in-water exit pits. Dredging can be done using trailing suction hopper dredgers, cutter suction dredgers, or mechanical dredging vessels. The area of potential dredging is currently unknown due to the dynamic nature of sand waves. However, sand wave clearance is anticipated to occur within three relatively small sections of the Falmouth ECC and not expected to occur in the Brayton Point ECC (refer to the EFH Assessment for more detail on potential sand wave clearance areas). During geophysical surveys along the Brayton Point ECC, the risk to the cable due to sediment mobility along the corridor was found to be low. However, seabed preparation or alternate burial methods may be required in the northern portion of the Falmouth ECC in Muskeget Channel and Nantucket Sound, where surficial boulders, subsurface boulders, geological units representing hardgrounds or glacial tills, or shallowly buried channels with variable soil properties have been identified. The seabed preparation may include dredging or leveling steep or mobile seabed features to facilitate achieving the targeted depth of lowering to ensure adequate burial over the life of the Project.

[1] As described in Chapter 2, Section 2.1.2, *Alternative B – Proposed Action,* Brayton Point is the preferred POI for both Project 1 and Project 2, and Falmouth is the variant POI for Project 2, which would be used if SouthCoast Wind is prevented from using Brayton Point for Project 2.

Within the Falmouth ECC, SouthCoast Wind anticipates a suction hopper dredger (or similar) would be used for seabed preparation activities over approximately five percent of the cable route. Dredging may additionally be used during decommissioning for vessels to unearth the cables prior to being reeled onto barges or other transport vessels.

Seafloor affected by dredging prior to cable installation would result in turbidity effects that have the potential to have temporary impacts on some sea turtle foraging habitat and prey species in the immediate area (e.g., benthic mollusks, crustaceans, sponges, sea pens, crabs); however, abundant similar habitat and prey would be found in adjacent areas, resulting in fewer impacts on sea turtles. As described in Section 3.5.7.3, *Impacts of Alternative A – No Action on Sea Turtles,* dredging could also contribute additional impacts on sea turtles related to impingement, entrainment, and capture associated with mechanical and hydraulic dredging techniques. Given the available information, the risk of injury or mortality of individual sea turtles resulting from dredging necessary to support offshore Project construction would be low, with impacts anticipated to be minor with no population-level effects.

Water quality impacts from cable emplacement would cause elevated suspended sediments. Inshore trenching and dredging could result in more extensive suspended sediment with concentrations above 100 mg/l (0.0008 pounds per gallon [lb/gal]) occurring at a maximum distance of 36 meters (118 feet). Maximum TSS levels are expected to drop below 10 mg/l (0.00008 lb/gal) in 2 hours, while drops below 1 mg/l (0.000008 lb/gal) are expected after less than 4 hours (COP Appendix F1; SouthCoast Wind 2024). Elevated turbidity levels would be temporary, lasting 1 to 6 hours in the immediate vicinity of the cable emplacement corridor. Physical or lethal effects are unlikely to occur because sea turtles are air-breathing and land-brooding and, therefore, do not share the physiological sensitivities of susceptible organisms like fish and invertebrates. Sea turtles may alter their behavior in response to elevated suspended sediment concentrations (e.g., moving away from an affected area) and may also experience behavioral stressors, like reduced ability to forage and avoid predators. However, sea turtles are migratory species that forage over wide areas and would likely be able to avoid temporarily suspended sediment impacts that are limited in severity and extent without consequence. Sea turtles would be expected to swim away from the sediment plume and return to the area once turbidity has returned to background levels.

To reduce impacts from cable emplacement, SouthCoast Wind will use HDD for sea-to-shore transition that will minimize sediment mobilization and seabed sediment alteration for cable burial operations. Individual sea turtles, when present, would be expected to successfully forage in nearby areas not affected by increased sedimentation, and only non-measurable, negligible impacts, if any, on individuals would be expected given the localized and temporary nature of the potential impacts.

Discharges/intakes: Increases in Project vessel discharges would occur during construction and installation, O&M, and decommissioning. As described under the No Action Alternative, certain discharges are required to comply with permitting standards that are established to minimize potential impacts on the environment. Impacts from entrainment and impingement of sea turtles and their prey associated with intakes for cable-laying equipment would be mostly confined to cable centerlines and would be short-term and minor.

The Proposed Action would also install HVDC converter OSP(s), which would result in the intake and discharge of water by the CWIS. SouthCoast Wind developed a NPDES permit application for one offshore HVDC converter OSP in the Lease Area for Project 1 (Appendix B, Figure B-2) (TetraTech and Normandeau Associates, Inc. 2023). If SouthCoast Wind selects HVDC technology for Project 2, the parameters and modeling results from the NPDES permit application for Project 1, described below, would be representative of a HVDC converter OSP for Project 2 located in the southern portion of the Lease Area. From four modeled maximum temperature delta scenarios, the distance from the discharge point where the temperature delta reached 1°C (1.8°F) was 41.9 feet (12.8 meters) in the fall, 84.9 feet (25.9 meters) in the winter, 67.5 feet (20.6 meters) in the spring, and 46.6 feet (14.2 meters) in the summer (TetraTech and Normandeau Associates, Inc. 2023). The effluent plume area was highest in the winter at 792.1 square feet (73.6 square meters) and lowest in the fall at 407.0 square feet (37.8 square meters). The risk of direct harm caused by heated effluent water or of entrainment or impingement of sea turtles during water cycling is negligible. The likelihood of sea turtle entrapment is low due to the seasonal nature and overall low sea turtle abundance in Project area waters. Mitigation measures proposed to reduce overall entrapment (e.g., intake velocity of 0.5 feet per second and a bar rack that will consist of three stainless steel bars approximately 0.8 inch (20 millimeters) wide fixed to the opening of the intake caisson) are expected to minimize these risks further. Impacts of water intake by HVDC converter OSPs would be limited to the entrainment of sea turtle prey. However, at this scale it is not expected to make any measurable difference in sea turtle prey availability. Heated effluent is not expected to impact sea turtle prey availability due to the relatively small discharge plume and localized temperature increase within the mixing zone.

Given the low abundance of sea turtles in the Project area, the low proportion of potentially entrained prey items, the small and localized effects from thermal discharge, and the mitigation measures in place to reduce potential risks, indirect impacts from the HVDC converter offshore substation platform on sea turtles are expected to be minor**.**

During installation of up to 85 suction-bucket jacket WTG foundations in the southern portion of the Lease Area as part of Project 2, planktonic organisms may also become entrained as water is pumped out of the buckets during the embedding process. An entrainment assessment was conducted to estimate the potential impact this construction activity may have on zooplankton and ichthyoplankton species present within the installation area (RPS 2024). The presence and abundance of plankton species in the SouthCoast Wind suction-bucket jacket installation area was determined using NOAA-NEFSC Ecosystem Monitoring (EcoMon) survey program plankton data (NEFSC 2019) limited to within 3.10 miles (5 kilometers) of the foundation installation area. This analysis area was used on the assumption that foundation installation is a one-time localized action with short-term entrainment impacts. Monthly entrainment estimates for suction-bucket foundation installations were calculated using a per foundation one-time total seawater displacement volume of 27,200 cubic meters (6,800 cubic meters per bucket x 4 buckets per foundation), the assumption that the installation of 85 suction-bucket jacket foundations would occur evenly over a 16-month period from April 2030 to July 2031, and the taxa-specific EcoMon plankton density data averaged by month.

A total of 91 plankton taxa were found to occur in the suction-bucket jacket entrainment analysis area of which 55 were zooplankton and 36 were ichthyoplankton (RPS 2024). The plankton species most susceptible to entrainment impacts are described in detail in Section 3.5.6.5, *Impacts of Alternative B – Proposed Action on Marine Mammals*. While less prevalent in the suction-bucket jacket entrainment analysis area, salps, which are prey for sea turtles, had a peak density of 27,562.04 individuals per 100 cubic meters in the month of October and a total estimated entrainment of 78,698,098 individuals throughout the duration of the foundation installation activity (RPS 2024). As the installation of suction-bucket jacket foundations is a one-time localized action, entrainment impacts are considered short-term and limited to the immediate vicinity of the installation activity. In a similar entrainment assessment conducted for the cooling water intake system of the Sunrise Wind Farm offshore converter station with an intake volume of 8.1 million gallons per day and an estimated annual entrainment for *C. finmarchicus* of 1.1 billion individuals, TRC (2022) reported that this magnitude of entrainment loss represented less than 0.1 percent of the estimated local population of this species in the Sunrise Wind Farm Lease Area. In comparison, plankton entrainment estimates from suction-bucket jacket installations are considerably less, would be a one-time event, and would impact an even smaller percentage of the plankton population in the vicinity of the SouthCoast Wind suction bucket foundation installation area. Therefore, the impacts associated with the entrainment of the planktonic prey of sea turtles is considered short-term and negligible.

EMFs and cable heat: The Proposed Action would entail a maximum of approximately 1,676 miles (2,697 kilometers) of cables, which includes 497 miles (800 kilometers) of interarray cables and 1,179 miles (1,897 kilometers) of offshore export cables. Sea turtles possess geomagnetic sensitivity (but not electro sensitivity) and are able to use Earth's magnetic fields for directional (compass-type) and positional (map-type) information used to aide in orientation, navigation, and migration (Normandeau et al. 2011). Sea turtle species have wide ranges of geomagnetic sensitivity, with loggerhead sea turtles able to detect fields from 0.00469 to 4,000 μT and green sea turtles able to detect fields from 29.3 to 200 μT (Normandeau et al. 2011). Interarray and ECCs would produce AC and DC EMF emissions. EMFs produced by AC and DC cables differ significantly in that AC transmissions vary rapidly in direction while DC transmissions are static (i.e., have a frequency of 0 Hz) (SouthCoast Wind 2024, Appendix P1). DC magnetic fields, such as those associated with submarine cables, can also combine with the Earth's static geomagnetic field altering the direction and/or magnitude of the resulting cable EMF. DC cable EMF interaction with the Earth's geomagnetic field will depend on the direction/orientation of the cable at the emplacement location (SouthCoast Wind 2024, Appendix P1). Additionally, DC electromagnetic fields average three times higher amplitude compared to those produced by AC cables (Hutchison et al. 2020). The maximum induced magnetic field and electrical field generated by the ECCs would be 1,859 milligauss (185.9 μT) directly above the cable centerline in the most conservative case, where cables are laid on the surface with cable protection. However, 85.5 milligauss (8.55 μT) measured at the seabed is the more likely scenario, where the cables are buried at a depth of 6.6 feet (2 meters) below the surface (SouthCoast Wind 2024, Appendix P1).

Sea turtles would likely encounter EMFs from Project-related submarine cables during foraging activities, but it is unlikely that this detection would interfere with foraging ability because other sensory cues are used as well (Constantino and Salmon 2003; Endres and Lohmann 2012; Narazaki et al. 2013). Given the extremely small area where exposure to this IPF would occur and the proposed burial depth of the submarine cable, impacts such as changes in swimming direction and altered migration routes would not be anticipated. SouthCoast Wind estimates that as much as 10 percent of interarray cable track, 10 percent of the Falmouth ECC, and 15 percent of the Brayton Point ECC will be unable to achieve the target burial depth of 6 feet. In areas where it is not feasible to achieve the target burial depth, additional cable protection will be installed. Cable protection may include concrete mattresses or rock placement over the cable. These coverings will provide additional shielding from EMF and will encourage sedimentation and encrusting growth to further bury the cables. Based on the EMF analysis conducted by SouthCoast Wind in the Project area, which found that EMF emitted by submarine cables would be well under typical detection ranges of magnetosensitive marine species, EMF impacts on sea turtles are expected to be negligible.

Buried submarine cables can warm the surrounding sediment in contact with the cables up to tens of centimeters (Taormina et al. 2018). No data is available on cable heat effects on sea turtles (Taormina et al. 2018). However, increased heat in the sediment could affect benthic organisms which serve as prey for sea turtles that forage in the benthos. Based on the narrowness of cable corridors and estimated area of thermal radiation, impacts on benthic organisms are not expected to be significant (Taormina et al. 2018) and would be limited to a small area around the cables. Considering the anticipated cable burial depths, thermal effects are not expected to occur at the surface of the seabed where benthic-feeding sea turtles would forage; therefore, any effects on a sea turtle's opportunity to forage and direct impacts to their prey from cable heat are considered to be minor.

Gear utilization: SouthCoast Wind's fisheries and benthic monitoring plans (INSPIRE 2023, 2024) propose a variety of survey methods to evaluate the effects of construction and operations on benthic habitat structure and composition and economically valuable fish and invertebrate species. The survey methods are explained in detail in Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*, which includes a discussion on the effects of gear utilization on prey species. The proposed survey methods include acoustic telemetry, drop camera, demersal trawl, ventless trap/pot, Neuston net sampling, video/photography surveys, sediment grab sampling, and SPI/PV. In addition to specific requirements for monitoring during the construction period, periodic PAM deployments may occur over the life of the Project for other scientific monitoring needs. All requirements of the Proposed Action will follow BOEM's 2021 Project Design Criteria and Best Management Practices (BOEM 2021c) to limit interactions with protected species.

A demersal otter trawl survey will be used to assess the abundance and distribution of target fish and invertebrate species within the offshore Project area. Trawl bottom time would be limited to 20 minutes and the vessel operating the trawl would tow at 3 knots. All tows would be completed during daylight hours, and trawling would be delayed if any turtles are sighted in the vicinity of the trawl tow. Available research indicates that limiting tow times to less than 30 minutes likely eliminates the risk of death for incidentally captured sea turtles (Epperly et al. 2002; Sasso and Epperly 2006). The proposed bottom-time and the use of trained observers for trawl surveys would reduce the likelihood of capture of sea turtles and minimize the risk of serious injury and mortality from forced submergence for sea turtles that are incidentally caught. Where possible, captured sea turtles would be disentangled and, if injured, may be brought back to rehabilitation facilities for treatment and recovery. This helps to reduce the rate of death from entanglement. Safe release, disentanglement protocols, and rehabilitation (Appendix G) would help reduce the severity of impacts of these interactions. However, potential measurable effects on sea turtles due to trawl surveys may still occur and cannot be discounted.

A ventless trap survey will be used to sample crab, lobster, and fish species present in the Project area (INSPIRE 2023, 2024). The leatherback sea turtle may be particularly vulnerable to entanglement in trap/pot fishing gear, possibly due to its physical characteristics, diving and foraging behaviors, distributional overlap with the gear, and the potential attraction to prey items that collect on buoys and buoy lines at or near the surface (NMFS 2016). To reduce the risk of vertical line entanglement, ropeless gear, in lieu of downlines will be deployed. The primary method for retrieving trap strings will be grappling, though on-demand systems will continue to be tested and potentially phased into the survey as the technology progresses and becomes logistically feasible. In the event of incidental sea turtle capture, survey vessels would be required to carry adequate disentanglement equipment and crew trained in proper handling and disentanglement procedures. Thus, while there exists a possibility of sea turtle capture or entanglement in ventless trap surveys, especially among leatherback sea turtles, the likelihood is considered very low with the proposed implementation of mitigation measures and limited duration of each survey event.

Acoustic telemetry to monitor the presence and movement of fish species would be conducted using fixed station acoustic receivers, and continuous observational periods will be implemented to detect the presence of sea turtles in the area. Monitoring surveys are also expected to occur at short-term, regular intervals over the duration of the monitoring program. Therefore, the potential for entanglement of sea turtles in acoustic telemetry survey equipment is considered extremely unlikely to occur.

Neuston net sampling involves towing a plankton net at slow speeds (4 knots) for brief periods (10 minutes) in the upper 1.6 feet (0.5 meter) of the water column. As the Neuston net frame measures 7.9 x 2 x 19.7 feet (2.4 x 0.6 x 6 meter) and features a mesh size of 0.5 inch (1,320 micrometers) and deployed off the stern of the vessel, this would not pose as an entanglement risk to sea turtles. Similarly, drop camera sampling occurs directly from the vessel's stern, with continuous seabed monitoring. As part of benthic monitoring surveys, a ROV stereo-camera system will be used to assess the effect of the introduction of hard-bottom novel surfaces while sediment grab samples and SPI/PV will be used to evaluate structure-oriented enrichment and measure changes in benthic function over time (INSPIRE 2024). As these surveys avoid gear that could entangle sea turtles, the risk of entanglement from Neuston net, drop camera, and benthic habitat monitoring surveys to sea turtles is considered extremely unlikely to occur.

A PAM plan will be submitted to NMFS and BOEM for review prior to the start of activities. Monitoring studies utilizing moored systems would be required to use the best available technology to reduce any potential risks of entanglement (Appendix G, *Mitigation and Monitoring*). Surveys are also expected to occur at short-term, regular intervals over the duration of the monitoring program. Therefore, passive acoustic equipment is not expected to pose a meaningful risk of entanglement to sea turtles.

While the patchy distribution and low densities of sea turtles within 3 miles (5 kilometers) of the SouthCoast Lease Area (<1 turtle per 100 square kilometers in and near the Lease Area for all species in any season) would reduce interactions with sea turtles, the potential for incidental capture and entanglement cannot be discounted should an individual be encountered during trawl surveys. However, given the short-term, low-intensity, and localized impacts of gear utilization under the Proposed Action, impacts on sea turtles are expected to be minor with no effects on the population level.

Lighting: Vessels and offshore structures associated with offshore wind activity would have deck and safety lighting, producing artificial light during the construction, O&M, and decommissioning phases of the Proposed Action. Additional lighting for night operations and during low-visibility conditions may be necessary within the Lease Area and ECCs during construction and decommissioning. Impacts of lighting on nesting females and hatchling turtles would not occur under the Proposed Action, as sea turtle nesting beaches do not occur north of Virginia and are not included in the Project area. As discussed in Section 3.5.7.3, *Impacts of Alternative A – No Action on Sea Turtles,* lighting on vessels and offshore structures could elicit attraction, avoidance, or other short-term, localized behavioral responses in sea turtles as well as some potential impacts to prey for some sea turtle species (Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*). Orr et al. (2013) indicated that lights on WTGs that flash intermittently for navigational or safety purposes do not present a continuous light source and, therefore, do not appear to have a disorienting influence for any sea turtle life history stages. Under the Proposed Action, up to 149 WTG/OSP positions would introduce continuous artificial light in the OCS. Vessels will be illuminated to provide safe working conditions for personnel, as dictated by the operations ongoing at that time. These operations include installation and removal of WTGs, OSPs, interarray cables, and export cables. During construction, continuous nighttime vessel lighting and construction area lighting would be required at the offshore location where the vessel and personnel are working. During O&M, SouthCoast Wind will utilize lighting during operations as required by the USCG, FAA, and/or relevant regulatory body and abide by all applicable standards. This includes lighting to be placed on all offshore structures that would be visible throughout a 360-degree arc from the surface of the water to aid in mariner navigation. SouthCoast Wind does not anticipate utilizing continuous lighting on the WTGs at the water's surface; however, SouthCoast Wind does plan to illuminate, at a minimum, the landing during crew transfers (specifically, the Walk to Work gate). SouthCoast Wind would implement an ADLS to only activate WTG lighting when aircrafts enter a predefined airspace. The short-duration synchronized flashing of the ADLS would have less impact on sea turtles at night than the standard continuous, medium-intensity red-strobe light aircraft warning systems, reducing activation of the system by 99 percent (COP Appendix Y3; SouthCoast Wind 2024).

Artificial light during construction, O&M, and decommissioning would be minimal and short-term (occurring primarily during construction and decommissioning), and those on WTGs and OSPs, while considered long-term, are intermittent and would represent a small fraction of light sources anticipated under the *No Action Alternative*. As such, BOEM expects impacts to sea turtles, if any, to be negligible.

Noise: Noise transmitted through water, through the seabed, or both can result in high-intensity, low-exposure-level, and long-term but localized intermittent risk to sea turtles. Underwater noise generated by the Proposed Action include impact pile driving (installation of WTGs and OSP), vibratory pile driving, geophysical surveys (HRG surveys), geotechnical drilling surveys, detonations of UXO, vessel traffic, aircraft, cable laying or trenching and dredging during construction, and WTG operation. While all of these noise sources occur during construction, only WTG operation, HRG surveys, vessel traffic, and cable laying or trenching for cable repairs, if necessary, would occur during operation. Decommissioning activities related to noise would likely be similar to or less than those outlined for construction activities (with the exception of impact pile driving for foundations). These noise sources would increase sound levels in the marine-receiving environment and may result in potential adverse effects on sea turtles in the Project area including harm (PTS) and harassment (TTS or behavioral disturbance), as described in Section 3.5.7.3, *Impacts of Alternative A – No Action on Sea Turtles*.

Noise – pile driving: Noise from pile driving would result in a potential risk of PTS and behavioral disturbance to sea turtles, which would occur intermittently during the installation of offshore structures. Depending on the construction scenario, pile driving would consist of either impact or vibratory pile driving. Each monopile requires 4 hours of driving to install (two piles driven per day), while each piled jacket foundation requires 2 hours of driving to install (eight piles driven per day). Up to 147 WTGs and up to 5 OSPs with a maximum of 149 WTG/OSP positions are anticipated for the Proposed Action. Maximum active piling duration for WTG foundations would be up to 588 hours (147 monopile WTGs times 4 hours per pile). The maximum active piling duration for OSP foundations would be up to 40 hours (2 hours per foundation, up to four foundations per OSP, and up to five OSPs). Sea turtle hearing sensitivity is within the frequency range (100 to 1,000 Hz) of sound produced by low-frequency sources such as marine drilling (for a summary, see Popper et al. 2014). Any sea turtle present in the area could be exposed to the noise from more than one pile-driving event per day, repeated over a period of days.

Pile-driving noise associated with the Proposed Action may result in temporary impacts, including behavioral and physiological effects on individual turtles, during pile-driving activities. Potential behavioral effects of pile-driving noise include altered dive patterns, short-term disturbance, startle responses, and short-term displacement (NSF and USGS 2011; Samuel et al. 2005). Potential physiological effects include temporary stress response and, when close to the pile-driving activity, TTS or PTS. Behavioral effects and most physiological effects are expected to be of short duration and localized to the ensonified area. Any disruptions to foraging or other normal behaviors would be temporary and increased energy expenditures associated with displacement are expected to be small. However, PTS could permanently limit an individual's ability to locate prey, detect predators, or find mates and could, therefore, have long-term effects on individual fitness. As described for the No Action Alternative, there have been no documented sea turtle mortalities associated with pile driving and no direct evidence of PTS occurring for sea turtles.

To estimate radial distances to injury and behavioral thresholds for pile driving, peak SPLs and frequency-weighted accumulated SELs for the onset of PTS in sea turtles from Finneran et al. (2017) and behavioral response thresholds from McCauley et al. (2000) were used (Table 3.5.7-4) based on the behavioral threshold recommended in the GARFO acoustic tool (GARFO 2020). Acoustic propagation was modeled at two representative locations in the Project area (Location 1 – 174 feet; Location 2 – 125 feet) and under different construction scenarios as listed below. Year 1 (corresponding to Project 1) assumes WTG foundation installations would use impact pile driving only (no vibratory pile driving). Year 2 (corresponding to Project 2) assumes WTG foundation installations would use either a combination of vibratory and impact pile driving or impact pile driving only. The modeling also includes concurrent installation of WTG foundations and OSP foundations during which only impact pile driving was assumed. Project-level exposure estimates used average sound speed profiles for "summer" months (April–November) and "winter" months (December–March). Installation of WTGs was modeled between May and December for Year 1 and Year 2, with concurrent installation of four pin-piles per day for OSP jackets modeled in October for both years.

1. **Year 1 – WTG monopiles, or WTG piled jackets, impact piling only with concurrent OSP installations.**
    a. *Scenario 1* – Sequential installation of 68 WTG monopile foundations (9/16 meters; assuming 1 pile per day for 44 of the monopiles and 2 piles per day for 24 of the monopiles) plus concurrent installation of OSP jacket (12, 4.5-meter pin piles) and 3 WTG monopile (9/16 meters; 1/day) foundations for a total of 71 WTG monopiles and 1 OSP jacket foundation.

    b. *Scenario 2* – Sequential installation of 81 WTG jacket foundations (1 jacket per day with 4, 4.5-meter pin piles per jacket) plus concurrent installation of OSP jacket (16, 4.5-meter pin piles) and 4 WTG jacket (1 jacket per day with 4, 4.5-meter pin piles per jacket) foundations for a total of 85 WTG jacket foundations and 1 OSP jacket foundation.

2. **Year 2 – WTG monopiles or WTG piled jackets, vibratory and impact piling with concurrent OSP installations.**
    a. *Scenario 1* – Sequential installation of 65 WTG monopile foundations (9/16 meters; assuming 1 pile per day for 35 of the monopiles and 2 piles per day for 30 of the monopiles) plus concurrent installation of OSP jacket (12, 4.5-meter pin piles) and 3 WTG monopile (9/16 meters; 1/day) foundations, all using only impact pile driving for a total of 68 WTG monopiles and 1 OSP jacket foundation.

    b. *Scenario 2* – Sequential installation of 67 WTG monopile foundations (9/16 meters; assuming 1 pile per day for 19 monopiles and 2 piles per day for 48 of the monopiles) using vibratory and impact piling plus concurrent installation of OSP jacket (12, 4.5-meter pin piles) and 3 WTG monopile (9/16 meters; 1/day) foundations using only impact pile driving, as well as 3 WTG monopile (9/16 meters; assuming 1 pile per day) foundations using only impact pile driving, for a total of 73 WTG monopiles and 1 OSP jacket foundation.

    c. *Scenario 3* – Sequential installation of 48 WTG jacket foundations (1 jacket per day with 4, 4.5-meter pin piles per jacket) using vibratory and impact piling and 10 WTG jacket foundations using only impact pile driving (1 jacket per day with 4, 4.5-meter pin piles per jacket) plus concurrent installation of OSP jacket (16, 4.5-meter pin piles per jacket) and 4 WTG jacket (4, 4.5-meter pin piles per jacket) foundations using only impact pile driving, for a total of 62 WTG jacket foundations and 1 OSP jacket foundation.

The acoustic modeling also included assumptions on the potential effectiveness of one or more noise abatement systems in reducing sounds propagated into the surrounding marine environment. The use of one or more noise abatement system is reasonably expected to achieve greater than 10 dB broadband attenuation of impact pile-driving sounds; therefore, noise abatement system performance of 10 dB broadband attenuation was assumed when calculating ranges to threshold levels and potential exposures.

Under any foundation installation scenario, the modeling results did not exceed SPL_{pk} thresholds for any sea turtles indicating that noise from a single pile-driving event would not cause injury or impairment when mitigated with a 10 dB broadband noise attenuation. The cumulative exposure ranges to injury (SEL_{cum}) for all sea turtle species under all foundation installation scenarios and combinations of vibratory and impact pile driving had a maximum range of 0.62 mile (1 kilometer) (Table 3.5.7-6). Exposure ranges were nearly identical between combined (impact plus vibratory) and sequential (impact only) installation scenarios, apart from an increase in exposure range for green sea turtles exposed under sequential jacket pin pile installation from <0.006 mile (<0.01 kilometer) to 0.09 mile (0.15 kilometer). Exposure ranges were largest under the concurrent, impact-only installation of WTG monopiles and OSP jacket pin piles in the summer followed by the sequential, impact-only installation of WTG monopiles (at 1 pile per day) in the winter. Exposure ranges were smallest for any installation scenario of WTG jacket pin piles. As the modeling assumed higher density estimates for leatherback sea turtle, this species exhibited the largest exposure range compared to the other sea turtle species, from 0.23–0.62 mile (0.37–1.00 kilometer). The next largest exposure range was calculated for the green turtle, with an exposure to injury range of <0.006–0.37 mile (0.01–0.60 kilometer). The Kemp's ridley turtle had a small exposure range, from 0–0.24 mile (0–0.39 kilometer), and the loggerhead turtle had the smallest exposure range from 0–0.14 mile (0–0.22 kilometer). Depending on species, sea turtles that remain within <0.006–0.62 mile (0.01–0.99 kilometer) of pile driving over 24 hours could experience PTS, assuming 10 dB of noise attenuation (Table 3.5.7-6).

Table 3.5.7-6. Exposure ranges to injury (SEL$_{cum}$[a]) thresholds for sea turtles under different WTG and OSP pile driving installation scenarios, assuming 10 dB of noise attenuation

Species	YEAR 2			YEARS 1 and 2		YEARS 1 and 2			
	Combined [b] (impact + vibratory)			Concurrent (impact only)		Sequential (impact only)			
	16 m WTG Monopile 1 pile/day	16 m WTG Monopile 2 piles/day	4.5 m WTG JPP 4 piles/day	16 m WTG Monopile and 4.5 m OSP JPP	4.5 m WTG JPP and 4.5 m OSP JPP	16 m WTG Monopile 1 pile/day	16 m WTG Monopile 2 piles/day	4.5 m WTG JPP 4 piles/day	4.5 m OSP JPP 4 piles/day
Exposure Ranges (km) during Winter									
Kemp's ridley turtle	—	—	—	—	—	0.31	—	0	0.13
Leatherback turtle	—	—	—	—	—	1	—	0.37	0.57
Loggerhead turtle	—	—	—	—	—	0.01	—	0	0
Green turtle	—	—	—	—	—	0.68	—	0.15	0.15
Exposure Ranges (km) during Summer									
Kemp's ridley turtle	0.2	0.39	0	0.35	0.03	0.18	0.39	0	0.13
Leatherback turtle	1	0.89	0.39	0.99	0.45	1	0.89	0.37	0.57
Loggerhead turtle	0.01	0.02	0	0.22	0	0.01	0.13	0	0
Green turtle	0.49	0.55	< 0.01	0.6	0.2	0.48	0.55	0.15	0.15

Sources: Limpert et al. 2024: Summarized from Tables 41–49; LGL 2024: Appendix A, Tables H-50–64.
Density estimates are derived from the Strategic Environmental Research and Development Program – Spatial Decision Support System (Kot et al. 2023).
Density estimates for leatherback sea turtles during the summer are averaged seasonal densities from 2011 to 2015 (Kraus et al. 2016).
Density estimates for loggerhead sea turtles during the summer were calculated as the averaged seasonal leatherback sea turtle densities scaled by the relative, seasonal sighting rates of loggerhead and leatherback sea turtles (Kraus et al. 2016).
Densities of Kemp's ridley sea turtles are used for green sea turtles, as Kraus et al. 2016 did not observe any green sea turtles in the Lease Area.
[a] SEL$_{cum}$ = weighted cumulative sound exposure level in decibels referenced to 1 microPascal squared second; also written L_E.
[b] Combined vibratory and impact pile driving would only occur in the summer months of Year 2.
dB = decibel; km = kilometer; m = meter; JPP = jacket pin piles; WTG = wind turbine generators; OSP = offshore service platform
dash (—) = no results because potential concurrent installation would only occur in the summer months

In addition to exposure ranges calculated with animal movement, the potential effects of sound were also summarized as acoustic radial distances, which are the distances over which at least 95 percent of the horizontal area that would be exposed to sound at or above the specified level occurred, assuming no animal movement (i.e., static receiver). Based on the modeled results at Location 1, pile-driving sound levels could exceed cumulative injury thresholds for a “static receiver” sea turtle that remained within 1.37–1.43 miles (2.2–2.3 kilometers) of the sound over 24 hours with 10 dB noise attenuation during monopile driving, and 0.81 mile (1.3 kilometers) during post-piled jacket pin-pile driving, or 0.56 mile (0.9 kilometer) during pre-piled jacket pin-pile driving (Table 3.5.7-7). At Location 2, the radial distances to cumulative injury thresholds were about 1.12 miles (1.8 kilometers) for monopile driving and 0.75 mile (1.2 kilometers) for post-piled jacket pin-pile driving, or 0.56 mile (0.9 kilometer) for pre-piled jacket pin-pile driving. Sound levels could exceed behavioral thresholds for a “static receiver” sea turtle during monopile driving with 10 dB of noise attenuation within 1.18–1.24 miles (1.9–2.0 kilometers) at Location 1 and 0.99–1.06 miles (1.6–1.7 kilometers) at Location 2. Sound levels could exceed behavioral thresholds within about 0.43 mile (0.7 kilometer) during post-piled jacket pin-pile driving with 10 dB noise attenuation at both locations. Behavioral thresholds could be exceeded at 0.31 mile (0.5 kilometer) during pre-piled jacket pin pile driving. Additionally, acoustic distances were slightly higher in the winter than in the summer at both locations.

Table 3.5.7-7. Summary of acoustic radial distances (R95% in kilometers) for sea turtles during monopile impact pile installation at the higher impact of two modeled locations for both seasons, with 10 dB noise attenuation

Scenario	Location 1			Location 2		
	Injury [a] L_{pk}	Injury [a] L_E	Behavior [b] L_p	Injury [a] L_{pk}	Injury [a] L_E	Behavior [b] L_p
Range (km) during Winter						
16 m Monopile Scenario, NNN 6600 (b) hammer	_	2.27	2.00	_	1.82	1.68
4.5 m Post-piled Jacket Scenario, MHU 3500S (b) hammer	_	1.30	0.73	_	1.22	0.73
4.5 m Pre-piled Jacket Scenario, MHU 3500S (b) hammer	_	0.93	0.48	_	0.93	0.52
Range (km) during Summer						
16 m Monopile Scenario, NNN 6600 (b) hammer	_	2.19	1.92	_	1.75	1.61
4.5 m Post-piled Jacket Scenario, MHU 3500S (b) hammer	_	1.30	0.72	_	1.18	0.72
4.5 m Pre-piled Jacket Scenario, MHU 3500S (b) hammer	_	0.92	0.48	_	0.91	0.53

Source: Limpert et al. 2024: Tables 50–55.
[a] Finneran et al. 2017.
[b] McCauley et al. 2000.
dB = decibels; km = kilometer; m = meter; L_{pk} = peak sound pressure level in decibels (dB) referenced to 1 microPascal squared; also written SPL_{pk}; L_E = weighted cumulative sound exposure level in dB referenced to 1 microPascal squared second; also written SEL_{cum}; L_p = root mean squared sound pressure level in dB referenced to 1 microPascal squared; also written SPL_{RMS} or L_{rms}; (–) dash indicates that distances could not be calculated because thresholds were not reached.

The same exposure modeling was also used to estimate the number of sea turtle species that could be exposed to injury and behavioral effects from pile driving (Table 3.5.7-8). Assuming 10 dB of noise attenuation, the results estimate the greatest Level A exposure in Year 1 would occur during the installation of 71 WTG monopiles and 12 OSP jacket pin piles (under Scenario 1) with a maximum of 2.15 leatherback sea turtles and <0.5 each of loggerhead, Kemp's ridley, and green sea turtles that may be exposed to cumulative sound levels exceeding recommended injury thresholds (SEL_{cum} or L_E) (Table 3.5.7-8). Similarly, in Year 2, the greatest Level A exposure would occur during the installation of 73 WTG monopiles and 12 OSP jacket pin piles (Scenario 2) with a maximum of 2.31 leatherback sea turtles and <0.5 each of loggerhead, Kemp's ridley, and green sea turtles that may be exposed to cumulative sound levels exceeding injury thresholds. No sea turtles were reported to be exposed during a single pile driving (SPL_{pk} or L_{pk}) event under any installation scenarios in both years.

For behavioral effects, the greatest Level B exposure would occur during the installation of 73 WTG monopiles and 12 OSP jacket pin piles (under Scenario 2 of Year 2) with a maximum of 6.25 leatherback sea turtles, 4.29 loggerhead sea turtles, and <0.5 each of Kemp's ridley and green sea turtles that may be exposed to sound exceeding behavioral thresholds (SPL_{rms} or L_p). Exposures were similar during the installation of 71 WTG monopiles and 12 OSP jacket pin piles (under Scenario 1 of Year1).

Generally, exposures were much lower under any scenario involving the installation WTG and OSP jacket pin piles, suggesting that foundation installations using jacket pin piling may lessen the extent of behavioral and injurious levels of disturbance than monopile driving. In addition, these exposure estimates do not consider potential behavioral avoidance or the use of PSOs, shutdown procedures, and other mitigation measures beyond the 10 dB noise attenuation applied during modeling, and are thus, considered conservative estimates of exposure.

The potential for injury and behavioral disturbance is minimized by implementing a range of applicant-proposed mitigation measures (Appendix G-1, *Mitigation Measures*). These measures include the implementation of noise-reduction technologies such as bubble curtains or a combination of systems (e.g., double big-bubble curtain, hydrosound damper plus big-bubble curtain) that can greatly reduce impact pile-driving sounds. Mitigation measures would also include pre-clearance, shutdown zones, and ramp-ups that would facilitate a delay of pile driving if sea turtles were observed approaching. Active visual monitoring of the zone of influence (820.2 feet [250 meters]) for sea turtles is considered highly effective in mitigating cumulative PTS effects. The proposed requirement that impact pile driving can only commence when the pre-clearance zones are fully visible to PSOs allows high sea turtle detection capability and enables a high rate of success in implementation of these zones to avoid disturbance. It is likely that the pre-clearance zone (1,640.2 feet [500 meters]) would cover the Level B harassment zone; however, as the modeled maximum acoustic radial distances leading to behavioral disturbance (e.g., 2 kilometers) exceeds the pre-clearance zone, the adaptive refinement of pile-driving monitoring and mitigation protocols through sound source verification would help reduce the probability of severe hearing impairment or serious injury as a result of pile-driving noise exposure.

Table 3.5.7-8. Estimated individuals exposed to injury and behavior threshold levels of sound under different installation scenarios for Years 1 and 2, assuming 10 dB of noise attenuation.

Species	Exposure Estimates (# individuals)														
	Year 1						Year 2								
	Scenario 1: 71 WTG monopiles and 12 OSP JPP			Scenario 2 [a]: 85 WTG jackets and 16 OSP JPP			Scenario 1 [a]: 68 WTG monopiles and 12 OSP JPP			Scenario 2 [b]: 73 monopiles and 12 OSP JPP			Scenario 3 [b]: 62 WTG jackets and 16 OSP JPP		
	Injury		Behavior	Injury		Behavior	Injury		Behavior	Injury		Behavior	Injury		Behavior
	L_{pk}	L_E	L_p	L_{pk}	L_E	L_p	L_{pk}	L_E	L_p	L_{pk}	L_E	L_p	L_{pk}	L_E	L_p
Kemp's ridley turtle	0	< 0.01	0.11	0	< 0.01	< 0.01	0	< 0.01	0.11	0	< 0.01	0.12	0	< 0.01	< 0.01
Leatherback turtle	0	2.15	5.61	0	0.59	1.77	0	1.97	5.71	0	2.31	6.25	0	0.4	1.25
Loggerhead turtle	0	0.16	3.94	0	0	3.45	0	0.12	4.03	0	0.19	4.29	0	0	2.6
Green turtle	0	< 0.01	0.1	0	< 0.01	< 0.01	0	< 0.01	0.1	0	< 0.01	0.11	0	< 0.01	< 0.01

Source: Limpert et al. 2024: Appendix H, Tables H-2–H-28.

Density estimates are derived from the Strategic Environmental Research and Development Program – Spatial Decision Support System (Kot et al. 2018).

Density estimates for leatherback sea turtles during the summer are averaged seasonal densities from 2011 to 2015 (Kraus et al. 2016).

Density estimates for loggerhead sea turtles during the summer were calculated as the averaged seasonal leatherback sea turtle densities scaled by the relative, seasonal sighting rates of loggerhead and leatherback sea turtles (Kraus et al. 2016).

Densities of Kemp's ridley sea turtles are used for green sea turtles, as Kraus et al. 2016 did not observe any green sea turtles in the Lease Area.

[a] Impact-only pile driving.

[b] Combined vibratory and impact pile driving.

dB = decibels; JPP = jacket pin piles; OSP = offshore substation platform; WTG = wind turbine generator; L_{pk} = peak sound pressure level in decibels (dB) referenced to 1 microPascal squared; also written SPL_{pk}; L_E = weighted cumulative sound exposure level in dB referenced to 1 microPascal squared second; also written SEL_{cum}

L_p = root mean squared sound pressure level in dB referenced to 1 microPascal squared; also written SPL_{rms} or L_{rms}

As pile driving may occur during nighttime hours and during periods of low visibility, visual monitoring will include the use of the best currently available technology (e.g., thermal camera systems, infrared spotlights, and night-vision devices) that can monitor clearance and shutdown zones to mitigate potential impacts. However, infrared/thermal devices have a limited ability to spot sea turtles in the field, making nighttime visual monitoring of sea turtles less reliable than daytime monitoring. Visual monitoring will be supplemented by passive acoustic monitoring (PAM) during impaired visibility at night or during daylight hours due to fog, rain, or high sea states. An Acoustic Protected Species Observer will be on watch during all pre-start clearance, piling, and post-piling monitoring periods (daylight, reduced visibility, and nighttime monitoring). A Nighttime Pile Driving Plan (NPDP) and an Acoustic Monitoring Plan (AMP) will be submitted to BOEM and NMFS for review (Appendix G-1). The AMP and NPDP will describe the methods, technologies, and mitigation requirements for any low-visibility or nighttime pile driving activities. The NPDP should sufficiently demonstrate the efficacy of the alternative technologies and methods in monitoring the full extent of clearance and shutdown zones in order for nighttime pile driving activities to be approved. In the absence of an approved NPDP, nighttime pile driving would only occur if unforeseen circumstances prevented the completion of pile driving during daylight hours, and it was deemed necessary to continue piling during the night to protect asset integrity or safety.

The potential for PTS and behavioral disturbance is considered extremely unlikely to occur for Kemp's ridley and green sea turtles given their rarity in the area; therefore, impacts leading to PTS and behavioral disturbance are expected to be negligible (<0.5 individual) for these two species. Impacts at the population level are also not anticipated given the low density of these species in the Project area and the localized nature of noise impacts.

Given the relatively small size of sea turtles and the significant time spent at or just below the surface, sea turtles may be difficult to monitor, especially during low light conditions or at night. While the measures described here may reduce the potential for PTS or behavioral disturbance in sea turtles, they would not completely eliminate such risks. However, as reported in the modeling results (Table 3.5.7-8), there is a low number of potential exposures expected from pile driving, thus, impacts from pile driving are likely to result in short-term, localized consequences to individuals that would not lead to population-level effects.

While the proposed mitigation and monitoring measures and the animal's ability to avoid areas of loud construction noise are expected to decrease the likelihood of pile-driving noise exposure, anticipated exposures above PTS and behavioral thresholds cannot be discounted for loggerhead and leatherback sea turtles because they are more common in the area. Therefore, the effects of noise exposure from Project pile driving leading to PTS or behavioral disturbance are anticipated in leatherback and loggerhead sea turtles but are considered to be short term and minor and would not have stock- or population-level effects.

Noise – G&G surveys (HRG surveys and geotechnical drilling activities): HRG surveys would be conducted to support final engineering design and construction. As described in Section 3.5.7.3, *Impacts* *of Alternative A – No Action on Sea Turtles,* survey noise could affect sea turtles through auditory injuries, stress, disturbance, and behavioral responses.

G&G surveys that use non-impulsive sources are not expected to affect sea turtles because they operate at frequencies above the sea turtle hearing range (e.g., multibeam echosounders, side scan sonar). BOEM (2021b) evaluated potential underwater noise effects on sea turtles from G&G surveys using impulsive sources (e.g., boomers, bubble guns, air guns, sparkers) and concluded that for an individual sea turtle to experience a behavioral response threshold of SPL greater than 175 dB re 1 µPa, it would have to be within 295 feet (90 meters) of a sparker or the loudest G&G sound source. NMFS (2021a) further states that none of the equipment being operated for HRG surveys—with frequencies that overlap with sea turtles' hearing—has source levels loud enough to result in permanent PTS. However, noise from impulsive sources used during HRG surveys could exceed the behavioral effects threshold (SPL: 175 dB re 1 µPa) within 105–118 feet (32–36 meters) from the source, based on the boomer and sparker systems proposed for the Project (NMFS 2021).

Given the limited spatial extent of potential noise effects, injury-level exposure (PTS) is unlikely to occur. Based on expected sea turtle avoidance, the speed of the survey vessels, and the lower noise levels and smaller operational scales of G&G survey equipment, G&G surveys associated with the Proposed Action are unlikely to result in injury of sea turtles in the Project area. While low-level behavioral exposures could occur, these disruptions would be limited in extent and duration given the movement of the survey vessel and the mobility of the animals and would have limited effects on both the individual and population.

SouthCoast Wind will implement several mitigation measures for HRG surveys, which include pre-clearance zones, shutdown zones, and ramp-up procedures (Appendix G, Table G-1). Pre-clearance and shutdown zones for sea turtles are set at 328 feet (100 meters), which is three times larger than the distance identified as exceeding sea turtle behavioral threshold for the proposed boomer and sparker equipment. Monitoring this zone for sea turtles is considered highly effective in mitigating effects from HRG surveys. With the application of these mitigation measures, the potential for sea turtles to be exposed to noise above behavioral thresholds is plausible but extremely unlikely to occur. As sea turtle peak pressure distances for all HRG sources are below the threshold level of 232 dB, noise from HRG surveys leading to PTS or injury is considered highly unlikely. Therefore, the effects from noise exposure from Project HRG surveys leading to injury or behavioral disturbance for sea turtles is considered to be minor as the impact is highly localized and would not result in population-level effects.

Noise – turbine operation: Maximum noise levels anticipated from operating WTGs are below recommended thresholds for sea turtle injury and behavioral effects. Additionally, noise levels are expected to reach ambient levels within a short distance (164 feet [50 meters]) of turbine foundations (Tougaard et al. 2009; Thomsen et al. 2015; Kraus et al. 2016; Miller and Potty 2017) and that sea turtles may acclimate to repetitive underwater noise and are expected to habituate to noise in the absence of an accompanying threat (Bartol and Bartol 2011; Hazel et al. 2007; U.S. Navy 2018). Underwater operational noise generated by offshore WTGs less than 6.15 MW has been measured to have SPLs ranging from around 80 to 135 dB re 1 µPa at various distances with frequencies between 10 hertz and 8 kilohertz, and the combined noise levels from multiple turbines would be lower or comparable to those of a small cargo ship (Tougaard et al. 2020). On the other hand, operational noise from larger WTGs on the order of 15 MW would generate higher SPL levels of 125 dB re 1 µPa measured 328 feet (100 meters) from the turbine during 22 miles per hour (10 meters per second) wind speeds (Tougaard et al. 2020). During these extremely high wind events, noise emissions could range up to 177 dB re 1 µPa-m (Stober and Thomsen 2021). However, the industry shift from using gear boxes to direct-drive technology could reduce emissions by 10 dB. Noise emissions at this level are unlikely to cause PTS or TTS in sea turtles but might result in behavioral effects such as avoidance of the area (Hazel et al. 2007). Further, while foraging sea turtles are not expected to be significantly affected if exposed to underwater noise from WTG operations, they may forage less efficiently due to increased energy spent due to avoidance behavior. Decreased foraging efficiency, especially if individuals move away from Nantucket Shoals, could have short-term metabolic effects resulting in physiological stress, but these effects would dissipate once the prey distribution no longer overlaps the underwater noise.

Current available data on sound levels produced by currently operating WTGs would have negligible impacts on sea turtles as these sound levels are below sea turtle behavior and injury thresholds. SouthCoast Wind is currently considering the use of both direct-drive and gear-driven current-generation turbines although the exact WTG type and supplier have not been finalized. If larger, gear-driven WTGs are selected to be installed under the Proposed Action, the turbines may produce sound levels exceeding recommended thresholds. However, more acoustic research is warranted to characterize sound levels originating from larger turbines, the potential for those turbines to cause TTS effects, and to what distance behavioral and masking effects are likely. Potential operational noise would likely be of low intensity and close to WTGs and would reach ambient underwater noise levels within a short distance of the foundations. Thus, if larger WTGs are installed and would produce sound levels exceeding recommended thresholds, operational noise associated with the Proposed Action may result in minor but localized impacts on sea turtles.

Noise – UXO detonation: UXO detonations could generate high pressure levels that could cause disturbance and injury to sea turtles. The Falmouth ECC does not overlap any UXO areas or Formerly Used Defense Sites (USACE 2019; AECOM 2020). The Brayton Point ECC intersects one land-based Formerly Used Defense Sites that is listed as closed out and complete but extends out into the Sakonnet River (USACE 2019). During BOEM's pre-screening process for the selection of the Massachusetts/Rhode Island Wind Energy Areas, the nearest UXO site was found 10 miles (16 kilometers) west of the Massachusetts/Rhode Island Wind Energy Area (BOEM 2013). A desktop study by SouthCoast Wind of UXO in the Offshore Project area concluded that there is a varying Low to Moderate risk from encountering UXO on site. The risk is Moderate throughout all of the Lease Area, and a relatively equal ratio between Low and Moderate within the ECCs (COP Appendix E.7; SouthCoast Wind 2024). UXO detonations would only occur from May through November. While this coincides with the highest densities of leatherback and loggerhead sea turtles, the potential for serious injury is minimized by the implementation of a range of mitigation and monitoring measures (Appendix G, *Mitigation and Monitoring*), and UXO detonation is a last resort. Other methods—such as avoidance, lift and shift, deactivation, using shaped charges that reduce the net explosive yield or that allow the UXO to burn at a slower rate, and avoiding instantaneous detonation—would be considered before a detonation. Proposed mitigation measures include establishing pre-clearance and shutdown zones that would facilitate a delay in detonations if sea turtles were observed approaching or within areas that could be ensonified above sound levels that could result in auditory and non-auditory injury. Pre-start clearance zones, commensurate with marine mammal hearing group and UXO charge weight, range from 1,312 to 28,543 feet (400 to 8,700 meters), which includes a 7,382-foot (2,250-meter) sea turtle clearance zone. Sixty minutes prior to detonation, this zone will be monitored visually by at least two PSO vessels (with two PSOs on watch). These ranges cover observed PTS/TTS ranges for sea turtles: <656 feet (<200 meters) lethal, 1,214 feet (370 meters) minor injury, and 1,969 feet (600 meters) no injury (U.S. Navy 2017a citing O'Keeffe and Young 1984). Any sightings of a sea turtle would cause the clock to restart, after the animal has moved out of the monitoring zone. Only one detonation would occur in a 24-hour period, with no nighttime detonation planned, and a 10 dB noise attenuation system would be used, similar to the system used for pile-driving activities.

Acoustic modeling has been conducted for SouthCoast Wind Project scenarios (Hannay and Zykov 2022). Maximum exceedance distance to TTS (Level B) and PTS (Level A) for the largest class of UXO with no mitigation in place were modeled to be 3,838.5 feet (1,170 meters) and 2,011.1 feet (613 meters), respectively (Table 3.5.7-9). Accounting for 10 dB mitigation, maximum exceedance distances for TTS and PTS for the largest class of UXO were modeled to be 1,309 feet (399 meters) and 692.2 feet (211 meters), respectively. The range to exceedance of Level-A and Level-B exposures were modeled at depths of 32.8–98.4 feet (10–30 meters) to approximate the ECC and 147.6–196.8 feet (45–60 meters) to approximate the Lease Area (Table 3.5.7-10). Range to Level A threshold exceedance was found to be 1,820.8 feet (555 meters) in the ECC and 984.2 feet (300 meters) in the Lease Area for the largest UXO charge size. Range to Level B threshold exceedance was found to be 6,988.2 feet (2,130 meters) in the ECC and 7,381.9 feet (2,250 meters) in the Lease Area under the largest UXO charge size. Ranges for the onset of mortality, non-auditory lung injury, and gastrointestinal injury in sea turtles were also modeled (Table 3.5.7-11). Under the largest UXO classification, mortality was found to occur at a range of 689 feet (210 meters) in the ECC and 734.9 feet (224 meters) in the Lease Area. Onset of non-auditory lung injury was found to occur at a range of 1,309.1 feet (399 meters) in the ECC and 1,483 feet (452 meters) in the Lease Area. The onset of gastrointestinal injury was found to occur at a range of 410.1 feet (125 meters).

Table 3.5.7-9. Sea turtles PTS and TTS maximum exceedance distances (meters) to TTS and PTS thresholds for peak pressure (L_{pk}) for various UXO charge sizes

Mitigation	TTS / PTS Lpk threshold (dB re 1 µPa)	E4 (2.3 kg)		E6 (9.1 kg)		E8 (45.5 kg)		E10 (227 kg)		E12 (454 kg)	
		TTS	PTS	TTS	PTS	TTS	PTS	TTS	PTS	TTS	PTS
Unmitigated	226/232	201	105	318	166	543	285	929	487	1,170	613
Mitigated 10 dB	226/232	69	36	108	57	185	98	317	168	399	211

Source: Hannay and Zykov 2022: Tables 10 and 33.
dB = decibel; kg = kilogram; PTS = permanent threshold shift; TTS = temporary threshold shift; UXO = unexploded ordnance; L_{pk} = peak sound pressure level in decibels referenced to 1 microPascal squared; also written as SPL_{pk}.

Table 3.5.7-10. Range (meters) to SEL PTS-onset and SEL TTS-onset thresholds in the ECC and Lease Area for sea turtles for five UXO charge sizes assuming 10 dB of noise attenuation, and the maximum area exposed above this threshold

Range per UXO Charge Size	ECC		Lease Area	
	PTS	TTS	PTS	TTS
E4 R95% Distance (km)	<50	134	<50	203
E6 R95% Distance (km)	72	358	<50	448
E8 R95% Distance (km)	190	796	63	870
E10 R95% Distance (km)	424	1,610	201	1,780
E12 R95% Distance (km)	555	2,130	300	2,250

Source: Hannay and Zykov 2022: Tables 46–55.
dB = decibel; ECC = export cable corridor; m = meter; PTS = permanent threshold shift; TTS = temporary threshold shift; UXO = unexploded ordnance; SEL = frequency weight sound exposure level in decibels referenced to 1 microPascal squared second; also written L_{E}.

Table 3.5.7-11. Ranges (meters) to the onset of mortality, non-auditory lung injury, and gastrointestinal injury thresholds in the Lease Area and ECCs for five UXO size classes assuming 10 dB of noise attenuation for sea turtles [a]

Range per UXO Charge Size	Mortality				Non-Auditory Lung Injury				GI Injury
	ECC		Lease Area		ECC		Lease Area		Lpk Threshold 237 dB re 1 uPA
	Juvenile	Adult	Juvenile	Adult	Juvenile	Adult	Juvenile	Adult	
E4 R95% Distance (m)	14	6	11	5	35	16	26	13	21
E6 R95% Distance (m)	39	18	26	14	88	43	83	34	34
E8 R95% Distance (m)	108	56	106	44	223	126	236	126	58
E10 R95% Distance (m)	233	151	253	155	441	298	497	326	99
E12 R95% Distance (m)	308	210	345	228	557	399	639	452	125

Source: Hannay and Zykov 2022: Summarized from Tables 34–44.
[a] GI injury combines ECC and Lease Area. Thresholds are based on animal mass and submersion depth.
dB= decibel; ECC = export cable corridor; GI = gastrointestinal; m = meters; UXO = unexploded ordnance; L_{pk} = peak sound pressure level in decibels referenced to 1 microPascal squared; also written as SPL_{pk}.

Given the low densities of sea turtles within 3 miles (5 kilometers) of the SouthCoast Lease Area (<1 turtle per 62.1 square miles (100 square kilometers) in and near the Lease Area for all species in any season), the low number of potential detonations required for the Proposed Action, and the strict implementation of mitigation measures, the potential for PTS/TTS, non-auditory injury, mortality, and behavioral disturbance from UXO detonations for the proposed Project are expected to be minor.

Noise – vessels: The frequency range for vessel noise (primarily 10–1,000 Hz) (MMS 2007) overlaps with sea turtles' known hearing range (less than 1,000 Hz with maximum sensitivity between 200 and 700 Hz; Bartol and Ketten 2006) and, therefore, the vessel noise would be audible to sea turtles in the vicinity. The increase in vessel traffic associated with the Project would occur during construction and O&M activities with an estimated 15–35 vessels operating at any given time. The construction vessels used for Project construction are described in COP Volume 1, Section 3.3.14 and Table 3-21 (SouthCoast Wind

2024). Typical large construction vessels used in this type of project range from 225–300 feet (68.6–91.4 meters) in length and can operate at speeds up to 13.8 miles per hour (12 knots). Underwater noise from vessel traffic, aircraft, geophysical surveys (HRG surveys and geotechnical drilling surveys), turbine operation, and dredging are unlikely to cause injury or death to sea turtles, but the additional noise may result in behavioral effects. Vessel noise associated with the Proposed Action could cause repeated, intermittent impacts on sea turtles resulting from short-term, localized behavioral responses. Behavioral effects are considered possible but would be temporary with effects dissipating once the vessel or individual has left the area. Although vessel noise may result in behavioral effects in how sea turtles use the Project area and nearby waters, impacts related to vessel noise would be short term and highly localized and, therefore, considered negligible to minor with no expected impacts on the population level.

Presence of structures: Impacts on sea turtles could result from the reef effect created by the presence of up to 149 foundations and between 390 acres (157 hectares) to greater than 1,700 acres (>686 hectares) of scour/cable protection. Of the foundations, a maximum of 85 may utilize suction-bucket jackets. The foundational footprints of suction-bucket jackets (4.90 acres) are larger than both pin-pile jackets (2.61 acres) and monopiles (2.52 acres). Suction-bucket jackets would create a larger temporary disturbance of the seafloor around the structure but would provide a larger area of hard-bottom habitat. The bottom habitat of the Project Area where construction would occur consists of soft-bottom habitat and is not known to be sea turtle foraging habitat. Studies have found increased biomass for benthic fish and invertebrates around artificial structures (Pezy et al. 2018; Raoux et al. 2017; Wang et al. 2019), indicating that offshore wind facilities could generate beneficial permanent impacts on local ecosystems, which may lead to behavioral changes related to foraging activities. The WTG and OSP foundations would provide some level of reef effect, likely increasing local prey availability, and may result in minor, long-term beneficial impacts on sea turtle foraging and sheltering. However, minor, long-term adverse impacts could occur as a result of increased interaction with fishing gear and vessels as the reef effect and associated increase in fish biomass could increase recreational fishing effort in and around turbine foundations, which may increase marine debris from fouled fishing gear in the area. Sea turtle entanglement in fishing gear is not considered a new IPF but rather a change in the distribution of fishing effort from other locations. The artificial reef may attract sea turtle predators to the area, increasing sea turtle predation risk. The risk of increased interactions with active or abandoned fishing gear would result in minor impacts on sea turtles, as impacts on or loss of individuals may occur, but no population-level impacts are expected.

The presence of in-water structures could reduce water flow immediately downstream of foundations but would return close to background levels within approximately eight pile diameters downstream of the pile center (Miles et al. 2017). WTGs can potentially alter atmospheric forcings that could affect surface mixing and changes in local water flow, as shown by models of the wind farms in the North Sea by Daewel et al. (2022). However, these model results reflect a much larger number of WTGs than the number currently expected to be installed in the Project area. Fine-scale effects on water flow could have localized impacts on prey distribution and abundance. As a result of the atmospheric wake effect, reductions in sea surface currents leading to alterations in upper ocean dynamics can potentially extend over 10s of kilometers downwind from offshore wind turbine arrays (Christiansen et al. 2022). Regional hydrodynamic effects could affect prey species at a broader scale. Effects on surface currents could also influence patterns of larval distribution (Chen et al. 2020; Johnson et al. 2021) and seasonal mixing regimes could influence primary productivity, both of which could, in turn, affect the distribution of fish and invertebrates on the OCS (Chen et al. 2018; Lentz 2017). Nantucket Shoals, adjacent to the Project area, is an important foraging area due to tidal currents and weather driven surface currents aggregating prey in a high-productivity area. The influence of structures in the Project area on regional hydrodynamics is not fully understood. Hydrodynamic alterations due to the presence of WTGs could increase primary productivity in the vicinity of the structures (Carpenter et al. 2016; Schultze et al. 2020). However, such an increase would be highly localized, and the increased productivity may be consumed by filter feeders colonizing the structures (Slavik et al. 2019) rather than leading to increased prey abundance for sea turtles.

Green sea turtles, loggerhead sea turtles, and Kemp's ridley sea turtles consume prey that are not strongly tied to physical oceanographic features such as currents and upwelling. However, leatherback sea turtles consume planktonic prey that are not able to move independently of normal ocean currents. Leatherback sea turtles are known to follow jellyfish aggregations and, thus, forage around areas of upwelling (Bailey et al. 2012). Nantucket Shoals, along with areas on Georges Bank and the edge of the continental shelf, have been found to create hotspots of prey for leatherback sea turtle foraging. The tidal mixing and upwelling in areas such as Nantucket Shoals increases productivity and gelatinous zooplankton numbers (Dodge et al. 2014). Since the leatherback sea turtle is pelagic, it is expected to be the most affected by local and regional hydrodynamic changes.

The presence of WTGs in the Project area may influence the distribution of jellyfish and, thus, affect the distribution of leatherback sea turtles. In addition to currents, the abundance and distribution of jellyfish are influenced by sea surface temperature and zooplankton prey availability (Gibbons and Richardson 2008). Changes in nutrient cycling resulting from altered oceanographic conditions due to the presence of WTG substructures may also affect jellyfish distributions. However, current research suggests that these changes could be highly localized (Floeter et al. 2017; Miles et al. 2017; Schultze et al. 2020) causing minimal impacts on the foraging resources of leatherback sea turtles. In addition, given the widespread range of leatherback sea turtle prey (NMFS and USFWS 2020), foraging resources would be available outside of the Project area if any alterations to jellyfish abundances were to occur.

Given the uncertainty around regional atmospheric and oceanographic offshore wind farm effects post-construction and the possibility of both increasing and decreasing prey availability depending on multiple environmental and Project-specific factors, impacts on sea turtle prey species and sea turtles from changes in hydrodynamics are not known at this time but are likely to vary both seasonally and regionally and are expected be localized, likely resulting in minor impacts. The presence of structures may also result in potential minor beneficial impacts due to increased foraging and sheltering opportunities, though these beneficial impacts may be offset given the increased risk of vessel interaction and gear entanglement.

After the conclusion of construction in the Project area, structures would enter the O&M phase. During this phase, structures would emit operational noise, which is discussed under the *Noise* IPF section. Operational structures would also require planned and unplanned maintenance. Conducting maintenance would involve sending maintenance vessels and lighting the structures so that maintenance and crew transfers can be complete. This would increase the impacts of vessel traffic and lighting in the Project area. The impacts related to maintenance would be temporary and localized only to the structures undergoing maintenance.

Port utilization: Port expansion is not proposed for the Project, therefore, direct impacts on sea turtles are not expected. Potential impacts from increased vessel traffic are discussed under the *Traffic* IPF.

Traffic: Based on the vessel traffic generated by the proposed Project, the Proposed Action would generate 15–35 construction vessels depending on construction activities with a maximum peak of 50 vessels that could be present in the Lease Area at one time when multiple phases of construction would be happening simultaneously (during construction and installation of offshore export cables, WTGs, OSP, and interarray cables). Increased vessel traffic associated with the Project may increase the potential for high-intensity impacts from vessel strikes during travel between multiple ports and the Lease Area. While Project vessel traffic would result in a measurable increase in vessel traffic in the Lease Area, this increase would be relatively low compared to the surrounding areas. Sea turtles are also expected to be highly dispersed in the Lease Area and the likelihood of co-occurrence between Project vessels and sea turtles is expected to be low.

Several factors contribute to the probability of vessel strikes, including the sea turtle density, time of year, sea turtle submergence rates, vessel type and speed, vessel trip numbers, and vessel trip distances. Sea turtles spend a majority (55–96 percent, depending on species) of time submerged (Eckert 1989; Hays et al. 2000; Lanyon et al. 1989) but can spend long periods of time at the surface during breathing and foraging activities (Hazel et al. 2007; Shimada et al. 2017), during which time they would be vulnerable to being struck by vessels or vessel propellers. Sea turtles are primarily vision-dependent and are only able to detect approaching vessels at approximately 33 feet (Hazel et al. 2007), thus, sea turtles may not be able to avoid collision from fast-moving vessels. Sea turtles may also be challenging to reliably detect from a moving vessel at sufficient distance to avoid vessel strike due to their high submergence rate or when they are just below the surface but within the vessel’s draft. There are limited measures that have been proven to be effective at reducing collisions between sea turtles and vessels (Schoeman et al. 2020). A range of mitigation and monitoring measures have been proposed and will be implemented that would serve to reduce the probability of a vessel strike, especially during peak vessel activity. These measures include reducing vessel speed to 4.6 mph (4 knots) when sea turtles are sighted within 328 feet (100 meters) of an operating vessel’s forward path. As previously mentioned, due to a sea turtle’s low-lying appearance, sea turtles may be difficult to detect during transits, especially during periods of low visibility (e.g., darkness, rain, or fog). During these conditions, visual observers will be equipped with night vision equipment and infrared/thermal imaging technology in efforts to reduce such risks. Collision risk will still be present due to the limited effectiveness of infrared/thermal devices to detect sea turtles. It is anticipated that potential exposure to vessel strike risk would be limited to sea turtles within surface habitats in the transit path between ports and the

Lease Area. Lookouts can advise vessel operators to slow the vessel or maneuver safely away from sea turtles, as well as observing for indicators of sea turtle presence such as drifting algal mats.

While the probability of vessel interactions with sea turtles generally would be low due to their seasonal presence with dispersed regional distribution, some unavoidable effects on sea turtles may still occur as reliably detecting sea turtles during transits would remain a challenge, thus, the risk of vessel strike cannot be discounted. The implementation of mitigation measures would lower the risk of vessel strikes, though not entirely eliminate the risk. Therefore, impacts on individual sea turtles due to vessel strikes under the Proposed Action would likely be minor and would not result in population-level effects.

Impacts of Alternative B on ESA-Listed Species

All sea turtle species in the geographic analysis area are either threatened or endangered and protected by the ESA. BOEM is preparing a BA for the potential effects on ESA-listed species under NMFS' jurisdiction, in which preliminary analyses indicate that the Proposed Action may affect and is likely to adversely affect ESA-listed sea turtles. The preliminary analysis in the draft BA indicates that auditory effects due to the Proposed Action are likely to adversely affect ESA-listed sea turtles. Green and Kemp's ridley turtles have low enough population numbers in the Project area such that effects from noise associated with the Proposed Action were deemed extremely unlikely to occur and, thus, discountable. However, noise from pile driving has the potential to result in PTS or behavioral disturbance of the more abundant leatherback and loggerhead sea turtles, and the IPF was determined likely to adversely affect these species. All other sources of noise leading to PTS or behavioral disturbance (G&G surveys, cable laying, dredging, UXO detonation) were found to be discountable and insignificant or to have no effect on ESA-listed sea turtles. While the probability of vessel interactions with sea turtles generally would be low due to their seasonal presence, their dispersed distribution in the Project area, and the proposed measures in place to avoid or minimize vessel strikes, Project vessel traffic was determined likely to adversely affect ESA-listed sea turtles due to the difficulty in reliably detecting sea turtles during vessel transits. Habitat disturbance or modification could result in decreased foraging habitat for the Kemp's ridley sea turtle and a decrease in foraging opportunities, increased entanglement risk in recreational fishing gear, turbidity effects, species avoidance or displacement, behavioral disruption, EMF and heat effects, or lighting effects for all ESA-listed sea turtles. However, these impacts are expected to be insignificant or discountable as they would be short term, localized, unlikely to occur/co-occur with species presence, or would not be measurable or measurably change risk. Gear utilization was determined likely to adversely affect ESA-listed sea turtles as the proposed trawl surveys have the potential for incidental capture or entanglement of individual sea turtles. Other effects (i.e., shifts or displacement of other ocean users) could result in displacement of fishing activity outside the Lease Area and may result in increased entanglement risk for ESA-listed sea turtles if shifts to fixed gear from mobile gear were to occur. While such a gear shift is not expected, the effects of fishing activity displacement are more likely to adversely affect leatherback and loggerhead sea turtles than Kemp's ridley and green sea turtles due to foraging strategies and presence in the pelagic Lease Area. However, such a gear shift is not expected, and effects of displacement are extremely likely to occur due to the low population size and patchy distribution of sea turtles in the Project area. BOEM concluded consultation with NMFS under the ESA on October 24, 2024.

Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned non-offshore wind and offshore wind activities. Planned non-offshore wind activities in the geographic analysis area that contribute to impacts on sea turtles include commercial fishing; marine transportation; military use; oil and gas activities; undersea transmission lines, gas pipelines, and other submarine cables; tidal energy projects; dredging and port improvement; marine minerals use, and ocean dredged material disposal.

The contribution of the Proposed Action to the impacts of accidental releases from ongoing and planned activities on sea turtles would likely be minimal. BOEM assumes all vessels would comply with USCG laws and regulations to properly dispose of marine debris and minimize releases of fuels/fluids/hazardous materials. Additionally, accidental large-scale releases are unlikely and impacts from small-scale releases would be localized and short term.

Export and interarray cables from the Proposed Action and planned offshore wind development would add an estimated 11,646 miles (18,742 kilometers) of buried cable to the geographic analysis area, of which the Proposed Action represents 14 percent. In context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to impacts of EMFs and heat from ongoing and planned activities; however, overall cumulative impacts would be negligible given the small area that would be affected by the projects compared to the remaining area of open ocean within the geographic analysis area.

The 149 structures for the Proposed Action represent only 5 percent of the 3,094 offshore wind structures that would add new sources of lighting on the OCS from existing and planned offshore wind farms. In context of reasonably foreseeable environmental trends, the Proposed Action would incrementally contribute to cumulative lighting impacts from ongoing and planned activities, which would be negligible as offshore lighting is anticipated to have minimal effect on adult sea turtles.

The 3,888 acres (1,573 hectares) of seabed disturbance from cable emplacement associated with the Proposed Action represents only 2 percent of the 185,710 acres (75,154 hectares) of seabed expected to be disturbed on the OCS due to existing and planned offshore wind farms, including the Proposed Action. While increases in foraging effort or displacement due to turbidity may occur to individual sea turtles, these temporary effects are not anticipated to lead to population-level effects on sea turtle populations. Therefore, the Proposed Action when combined with past, present, and reasonably foreseeable projects would result in minor impacts on sea turtles.

Planned offshore wind activities would generate comparable types of noise impacts to those of the Proposed Action. The most significant sources of noise are expected to be pile driving followed by vessels. The 149 structures for the Proposed Action represent only 5 percent of the 3,094 offshore wind structures anticipated on the OCS for existing and planned offshore wind farms, including the Proposed Action, although some foundations from the Proposed Action and other wind farms may be installed without pile driving. Project vessels would represent only a small fraction of the large volume of existing traffic in the geographic analysis area. In context of reasonably foreseeable environmental trends, the

Proposed Action would incrementally contribute to cumulative noise impacts on sea turtles from ongoing and planned activities, which would be minor overall.

The contribution of the Proposed Action to impacts of vessel traffic from ongoing and planned activities would be small given the large volume of existing vessel traffic in the geographic analysis area. The cumulative impact from vessel traffic is anticipated to be the same as the Proposed Action, minor, assuming other offshore wind projects adopt similar AMM measures to reduce the potential of vessel strikes.

The deployment of gear used for fisheries and benthic monitoring surveys under the Proposed Action would contribute to the cumulative impact of gear utilization in the region. However, the contribution of the Proposed Action to overall gear usage in the area is minimal, and the cumulative impacts on sea turtles would likely be minor overall.

The Proposed Action would contribute incremental impacts to sea turtles through the installation of up to 149 foundations. In combination with other offshore wind projects (estimated 3,094 offshore wind structures) would cumulatively contribute to impacts on sea turtles, primarily associated with the beneficial artificial reef effects, adverse impacts from fishing gear entanglement, and hydrodynamic effects on the distribution of jellyfish prey. Cumulative impacts on sea turtles would be minor overall.

Conclusions

Impacts of Alternative B – Proposed Action. Noise produced by activities associated with Alternative B, primarily from pile driving, may cause PTS or behavioral disturbance in leatherback and loggerhead sea turtles that commonly occur in the Project area; however, behavioral disturbance is not anticipated to result in fitness level consequences. The mitigation and monitoring measures (Appendix G, *Mitigation and Monitoring*) would minimize noise exposure and the potential for PTS and behavioral disturbance, thus, impacts on sea turtles are expected to be **minor adverse**. Impacts that have the potential to result in mortality and serious injury from vessel strikes and gear entanglement would be minimized by the implementation of mitigation measures required as part of the environmental permitting processes included in Appendix G, thus, impacts are expected to be **minor**. Overall, project construction and installation, O&M, and conceptual decommissioning would result in habitat disturbance, entrainment and impingement, underwater and airborne noise, water quality degradation, vessel traffic (strikes and noise), artificial lighting, and potential discharges/spills and trash. As described previously, with the implementation of mitigation and monitoring measures included in Appendix G, only leatherback and loggerhead sea turtles that are more common in the area are anticipated to incur PTS incidental to pile driving or would be susceptible to vessel strikes or entanglement. BOEM anticipates the impacts resulting from the Proposed Action would result in **minor adverse** impacts. Adverse impacts are expected to result mainly from pile-driving noise, the risks of gear entanglement/capture, and the risk of vessel strike from increased vessel traffic. Some **minor beneficial** impacts could be realized through artificial reef effects. Beneficial effects, however, may be offset given the increased risk of entanglement due to derelict fishing gear on the structures.

Cumulative Impacts of the Proposed Action: Cumulative impacts associated with the Proposed Action when combined with impacts from ongoing and planned activities including offshore wind would result in **minor adverse** impacts on sea turtles. The main drivers for these impact ratings are pile-driving noise and associated potential for auditory injury, the presence of structures, ongoing climate change, and ongoing vessel traffic posing a risk of collision. The Proposed Action would contribute to the cumulative impact rating primarily through pile-driving noise, vessel traffic, and the presence of structures. BOEM made this decision because the overall effect would be detectable and measurable, but these impacts would not result in population-level effects.

3.5.7.6 Impacts of Alternatives C and F on Sea Turtles

Impacts of Alternatives C and F: Under Alternative C, the Brayton Point ECC would be routed onshore to avoid fisheries impacts in the Sakonnet River. Alternative C-1 and Alternative C-2 would reduce the offshore portion of the Brayton Point ECC by 9 miles and 12 miles (14 and 19 kilometers), respectively. The alternatives would avoid the potential impacts on sea turtles in the Sakonnet River; however, sightings of sea turtles in the Sakonnet River are uncommon, and cable emplacement impacts from the other portions of the offshore cable corridors would still occur. Kemp's ridley sea turtle is the only species that would be expected to benefit from the prevention of construction in the Sakonnet River, but this benefit is not expected to be significant. Kemp's ridley sea turtle is associated with coastal habitats and is known to forage in bays and estuaries across Rhode Island in the summer months (Schwartz 2021). Aside from avoiding impacts on potential Kemp's Ridley foraging habitat, impacts on sea turtles discussed under Alternative B remain relevant to Alternative C. The reduction of underwater impacts would only occur in an area that is not frequently used by most sea turtle species. Therefore, no measurable difference in the impacts on sea turtles are expected between the Proposed Action and Alternative C.

Under Alternative F, to minimize seabed disturbance in the Muskeget Channel, the Falmouth offshore export cable route would use up to three ±525kV HVDC cables connected to one HVDC converter OSP, instead of up to five HVAC cables connected to one or more HVAC OSPs as proposed under the Proposed Action. The additional HVDC converter OSP associated with Falmouth would be located in deeper waters in the southern portion of the Lease Area at a further distance from Nantucket Shoals. During operation, there would be increased intake and discharge from the additional HVDC converter OSP, which could result in increased entrainment of sea turtle prey compared to the Proposed Action. While the likelihood of sea turtle entrapment would be low due to the seasonal nature and overall low sea turtle abundance in Project area waters, mitigation measures proposed to reduce overall entrapment (e.g., intake velocity of 0.5 feet per second or less and a bar rack that will consist of three stainless steel bars approximately 0.8 inch [20 millimeters] wide fixed to the opening of the intake caisson) further minimizes the risk of entrapment in the unlikely event of a sea turtle encounter. Given the CWIS depth of withdrawal, the small and localized effects from thermal discharge, and the application of mitigation measures to reduce entrainment, OSP operations are not expected to make any measurable difference in sea turtle foraging and prey availability. The addition of a second OSP is not expected to significantly elevate the risk of entrapment for sea turtles or negatively affect prey availability compared to the Proposed Action (the Proposed Action also includes the potential for multiple HVDC converter OSPs). Any impacts on sea turtles or their prey would remain localized near the OSP locations, and the overall impact magnitude would be the same.

Additionally, the Falmouth offshore export cable route would include up to three HVDC cables compared to up to five HVAC cables under the Proposed Action, which would reduce the total seafloor disturbance by approximately 700 acres (2.8 square kilometers). Although the number of cables would be reduced, the DC current carried by the HVDC export cables can create an EMF with three times the amplitude of an EMF created by AC cables (Hutchison et al. 2020). However, AC and DC EMFs differ in the way they interact with organisms and direct comparisons cannot be made (CSA Ocean Sciences, Inc. and Exponent 2019). Measures to reduce EMFs in the surrounding area, including cable burial and shielding where sufficient burial is not possible, are expected to reduce the EMF of DC cables to levels where impacts from EMFs are localized to the immediate area of the cable (CSA Ocean Sciences, Inc. and Exponent 2019). Offshore impacts on sea turtle prey from cable emplacement and anchoring may also be reduced under Alternative F due to the fewer number of cables installed. Because impacts associated with cable installation and maintenance would still occur in the same corridor and there would be no change in impacts from other offshore components (e.g., WTGs), the impacts on sea turtles under Alternative F would be reduced but not materially different than those described for the Proposed Action.

Cumulative Impacts of Alternatives C and F: In the context of reasonably foreseeable environmental trends, cumulative impacts of Alternative C and Alternative F would be similar to those described under the Proposed Action.

Impacts of Alternatives C and F on ESA-Listed Species

Impacts of Alternatives C and F on ESA-listed species would not be significantly different from the IPFs discussed in the Proposed Action.

Conclusions

Impacts of Alternatives C and F: Through Alternatives C and F, BOEM expects small reductions in underwater noise from cable emplacement, vessel traffic, and bottom habitat disturbance. However, impacts relating to construction and maintenance would still occur in the Lease Area and cable corridor. Because sea turtle impacts are most likely to occur in this area, the impacts of Alternative C and Alternative F would not differ significantly from the impacts of the Proposed Action. Therefore, construction and installation, O&M, and decommissioning of Alternative C and Alternative F would likewise result in **minor adverse** impacts and could include potentially **minor beneficial** impacts.

Cumulative Impacts of Alternatives C and F: In the context of reasonably foreseeable environmental trends, BOEM anticipates that the cumulative impacts of Alternative C and Alternative F would be similar to the Proposed Action and result in **minor adverse** impacts on sea turtles in the geographic analysis area.

3.5.7.7 Impacts of Alternative D (Preferred Alternative) on Sea Turtles

Impacts of Alternative D: Alternative D addresses potential impacts on hydrodynamic features and foraging habitat for several species of birds and whales, which may also contribute to changes of impacts on sea turtles. The area of concern in Alternative D is the Nantucket Shoals, an area of elevated sea floor that creates an upwelling, and thus, ideal conditions for plankton growth. Leatherback sea turtles use this area for foraging due to its unique geography. Oceanographic features, such as mesoscale eddies, convergence zones, and areas of upwelling like those in the Nantucket Shoals, attract foraging leatherbacks because these features are often associated with aggregations of jelly fish (Bailey et al. 2012). The removal of WTGs under Alternative D would reduce construction and installation impacts from noise, vessel traffic, and anchoring when compared to the Proposed Action. The reduction of six turbines would likely not have an appreciable impact on hydrodynamic and atmospheric wake effects of the WTGs, as further described under the analysis of Alternative D in Section 3.5.6, *Marine Mammals*. Impacts associated with sea turtle prey dispersal and availability are not expected to differ from the Proposed Action. Since the number of WTGs to be removed would be small relative to the total number of WTGs, BOEM does not expect a measurable reduction in impacts on sea turtles compared to the Proposed Action.

Cumulative Impacts of Alternative D: In the context of reasonably foreseeable environmental trends, cumulative impacts of Alternative D would be similar to those described under the Proposed Action.

Impacts of Alternative D on ESA-Listed Species

Impacts of Alternative D on ESA-listed species would be the same as the IPFs discussed for the Proposed Action.

Conclusions

Impacts of Alternative D: Impacts of Alternative D would not differ from the impacts of the Proposed Action, except a slight reduction in noise impacts and vessel traffic from construction and installation. Therefore, construction and installation, O&M, and decommissioning of Alternative D would likewise result in **minor adverse** impacts and could include potentially **minor beneficial** impacts as described in Section 3.5.7.5, *Impacts of Alternative B – Proposed Action on Sea Turtles*.

Cumulative Impacts of Alternative D: In the context of reasonably foreseeable environmental trends, BOEM anticipates that the cumulative impacts of Alternative D would be similar to the Proposed Action and result in **minor adverse** impacts on sea turtles in the geographic analysis area.

3.5.7.8 Impacts of Alternative E on Sea Turtles

Impacts of Alternative E: Alternative E includes the use of all piled (Alternative E-1), all suction bucket (Alternative E-2), or all GBS (Alternative E-3) foundations for WTGs and OSPs. Installation activities would not differ between the Proposed Action and Alternative E-1, which assumes pile driving would be used for all foundations with corresponding noise impacts. Under Alternative E-2 and Alternative E-3, no pile driving would occur; therefore, there would be no underwater noise impacts on sea turtles due to pile driving. The avoidance of pile-driving noise impacts would reduce overall construction and installation impacts on sea turtles under Alternative E-2 and Alternative E-3 compared to the Proposed Action. Cable emplacement and the number of structures constructed under Alternative E remains the same as the Proposed Action.

Gravity-based foundations, under Alternative E-3, would result in the greatest area of habitat conversion due to foundation footprint and scour protection at 11.55 acres per foundation. Alternative E-1 would result in at least a 77 percent reduction in footprint and scour protection from up to 2.61 acres per foundation, and Alternative E-2 would result in at least a 58 percent reduction in footprint and scour protection from 4.9 acres per foundation, compared to Alternative E-3. Larger foundation footprints under Alternatives E-3 and E-2 would result in loss of more soft-bottom habitat than Alternative E-1, which would primarily affect Kemp's ridley sea turtles as they forage in this type of habitat. Alternatives E-2 and E-3 may have a greater artificial reef effect with increased surface area, which would be a potential beneficial impact on sea turtles. However, adverse impacts from these larger underwater structures may include entanglement in lost or discarded fishing gear, potential of vessel strike from increased recreational fishing vessel traffic, and incidental hooking. For example, the GBS of Alternative E-3 may have less entanglement potential as it has a smooth, sloping exterior in the water column compared to the suction bucket foundation of Alternative E-2 that has metal cross beams, which may create more entanglement potential of marine debris and recreational fishing gear. Given that Alternative E includes increases in both beneficial and adverse impacts, there is not expected to be a measurable difference in impacts on sea turtles from those anticipated under the Proposed Action.

Cumulative Impacts of Alternative E: In the context of reasonably foreseeable environmental trends, cumulative impacts of Alternative E would be similar to those described under the Proposed Action.

Impacts of Alternative E on ESA-Listed Species

Impacts of Alternative E on ESA-listed species would be the same as the IPFs discussed for the Proposed Action.

Conclusions

Impacts of Alternative E: Impacts of Alternative E-1 would not be measurably different from the impacts of the Proposed Action. Construction and installation, O&M, and decommissioning of Alternative E-1 would likewise result in **minor adverse** impacts and could include potentially **minor beneficial** impacts.

Impacts of Alternative E-2 and Alternative E-3 would be similar to impacts of the Proposed Action with the most notable difference the avoidance of impact pile-driving noise impacts and increase in artificial reef effects. Construction and installation, O&M, and decommissioning of Alternative E-2 and Alternative E-3 would result in **minor adverse** impacts and could include potentially **minor beneficial** impacts.

Cumulative Impacts of Alternative E: In the context of reasonably foreseeable environmental trends, BOEM anticipates that the cumulative impacts of Alternative E would be similar to the Proposed Action and result in **minor** adverse impacts on sea turtles in the geographic analysis area.

3.5.7.9 Comparison of Alternatives

Construction, O&M, and decommissioning of Alternatives C, D, E, and F would have the same overall **minor adverse** impacts and **minor beneficial** impacts on sea turtles as described under the Proposed Action. The Proposed Action would result in habitat disturbance, entrainment and impingement, underwater and airborne noise, water quality degradation, vessel traffic (strikes and noise), artificial lighting, and potential discharges/spills and trash. Adverse impacts are expected to result from pile-driving noise and increased vessel traffic, and beneficial impacts are expected from the presence of structures. The Sakonnet River is not frequently used by sea turtles, and aside from some reduction in impacts by avoiding potential Kemp's ridley sea turtle foraging habitat, impacts on sea turtles under Alternative C would be the same as the Proposed Action. Under Alternative F, the reduction in the number of cables in the Falmouth ECC could have a small reduction in impacts on sea turtle prey from cable installation and seabed disturbance. The addition of a second OSP is not expected to significantly elevate the risk of entrapment for sea turtles or negatively affect prey availability compared to the Proposed Action. Since the number of WTGs to be removed under Alternative D would be small relative to the total number of WTGs, BOEM does not expect a measurable reduction in impacts on sea turtles compared to the Proposed Action. In contrast to Alternative E-1, which assumes all piled foundations, Alternatives E-2 and E-3 would not result in pile-driving noise and would reduce overall construction and installation impacts on sea turtles. Conversely, Alternatives E-2 and E-3 have bigger foundation footprints and would result in the greatest area of habitat conversion, while also resulting in the greatest beneficial artificial reef effect. Because Alternative E includes increases in both beneficial and adverse impacts, it is not expected to result in a measurable difference in impacts on sea turtles from those anticipated under the Proposed Action.

3.5.7.10 Proposed Mitigation Measures

Additional mitigation measures identified by BOEM and cooperating agencies as a condition of federal permitting, or through agency-to-agency negotiations, are described in detail in Appendix G, Tables G-2, G-3, and G-4 and summarized and assessed in Table 3.5.7-13. If one or more of the measures analyzed here are adopted by BOEM or cooperating agencies, some adverse impacts on sea turtles could be further reduced. After publication of the Draft EIS, BOEM conducted ESA consultation with NMFS, which resulted in NMFS issuing Reasonable and Prudent Measures and Terms and Conditions that are analyzed collectively in Table 3.5.5-12.

Table 3.5.7-12. Mitigation and Monitoring Measures Resulting from Consultations (also identified in Appendix G, Table G-2): sea turtles

Measure	Description	Effect
Draft NMFS Biological Opinion Reasonable and Prudent Measures	The Lessee must comply with measures in the Biological Opinion and conduct Sound Field Verification to ensure distances to thresholds for ESA-listed sea turtles are not exceeded during impact pile driving. SouthCoast must also report any effects to ESA-listed sea turtles or incidental take of these species.	Reasonable and Prudent Measures and Terms and Conditions from the NMFS Biological Opinion would minimize impacts on sea turtles during construction and installation and O&M of the Project. While adoption of this measure would decrease risk to sea turtles under the Proposed Action, it would not alter impact determinations for sea turtles.

Table 3.5.7-13. BOEM or agency-proposed measures (also identified in Appendix G, Table G-3): sea turtles

Measure	Description	Effect
Pile-driving time of year restriction in enhanced mitigation area	Pile driving within the enhanced mitigation area will occur only between June 1 and October 31 when NARW presence is at its lowest.	The time-of-year restriction in the enhanced mitigation area would ensure that NARWs would not be exposed to injurious levels of noise from pile-driving activities. This measure would also be protective to sea turtles that are known to forage in these areas. While the implementation of this measure would minimize the risk to sea turtles from this construction activity under the Proposed Action, it would not change the impact determination for impact pile-driving noise.

Measures Incorporated in the Preferred Alternative

Mitigation measures required through completed consultations, authorizations, and permits or proposed by BOEM listed in Table 3.5.7-12 and Tables G-2, G-3, and G-4 in Appendix G are incorporated in the Preferred Alternative. These measures, if adopted, would further define how the effectiveness and enforcement of mitigation measures would be ensured and improve accountability for compliance with mitigation measures by requiring the submittal of plans for approval by the enforcing agencies and by defining reporting requirements. Because these measures ensure the effectiveness of and compliance with mitigation measures that are already analyzed as part of the Proposed Action, these measures would not further reduce the impact level of the Proposed Action from what is described in Section 3.5.7.5, *Impacts of Alternative B – Proposed Action on Sea Turtles*.

3.5 Biological Resources

3.5.8 Wetlands

This section discusses potential impacts on wetlands from the proposed Project, alternatives, and ongoing and planned activities in the geographic analysis area. The wetlands geographic analysis area, as shown on Figure 3.5.8-1, includes all subwatersheds that intersect the Onshore Project area, which encompasses all wetlands and surface waters that are most likely to experience impacts from the proposed Project. See Section 3.4.2, *Water Quality*, for a discussion of impacts on water quality.

3.5.8.1 Description of the Affected Environment

Wetlands and vernal pools[1] in the Massachusetts part of the geographic analysis area were mapped using the Mass GIS 2005 Wetlands detailed dataset (MassGIS 2017), and the National Wetlands Inventory (NWI) (USFWS 2021) was used to map wetlands in the Rhode Island part of the geographic analysis area.[2] SouthCoast Wind also delineated wetlands during field surveys conducted within the onshore substation sites in Falmouth; however, the field delineation report for the onshore substation sites under consideration in Falmouth is private data and, therefore, has not been provided. Additional field delineations will be completed as part of the federal (CWA Section 404) and state permitting processes as necessary (COP Volume 2, Section 6.4.1.1; SouthCoast Wind 2024). Impacts on regulated wetland resources would require authorization under federal permits issued by USACE pursuant to the CWA, state permits or authorizations pursuant to the Massachusetts Wetland Projection Act and RIDEM Coastal Resources Management Council, and local municipal wetland bylaws. CWA Section 404 requires that all appropriate and practicable steps be taken first to avoid and minimize impacts on jurisdictional wetlands; for unavoidable impacts, compensatory mitigation may be required to replace the loss of wetlands and associated functions.

The Falmouth Onshore Project area lies entirely within one watershed: Wequaquet Lake (Hydrologic Unit Code [HUC] 10900020206). Characteristic wetland types occurring in the Falmouth Onshore Project area include palustrine wetland types, such as red maple swamps, Atlantic white cedar bogs, kettlehole bogs, highbush blueberry thickets, shrub swamps, and emergent marsh (COP Appendix J, Section 4.1.4; SouthCoast Wind 2024). Examples of natural wetland communities common to Upper Cape Cod are further described in Appendix B, *Supplemental Information and Additional Figures and Tables*.

[1] Originally defined and protected under the Massachusetts Wetlands Protection Act Regulations, Certified Vernal Pools also receive protection under: Title 5 of the Massachusetts Environmental Code, Section 401 of the Clean Water Act, the Massachusetts Surface Water Quality Standards, and the Massachusetts Forest Cutting Practices Act (MassDEP 2022a).

[2] BOEM also reviewed University of Rhode Island (URI) Environmental Data Center and Rhode Island Geographic Information System (RIGIS) Wetlands datasets (RIDEM 2022) but found that the NWI wetland mapping appeared more accurate in the Project area based on desktop review of aerial imagery overlaid with the wetland datasets.

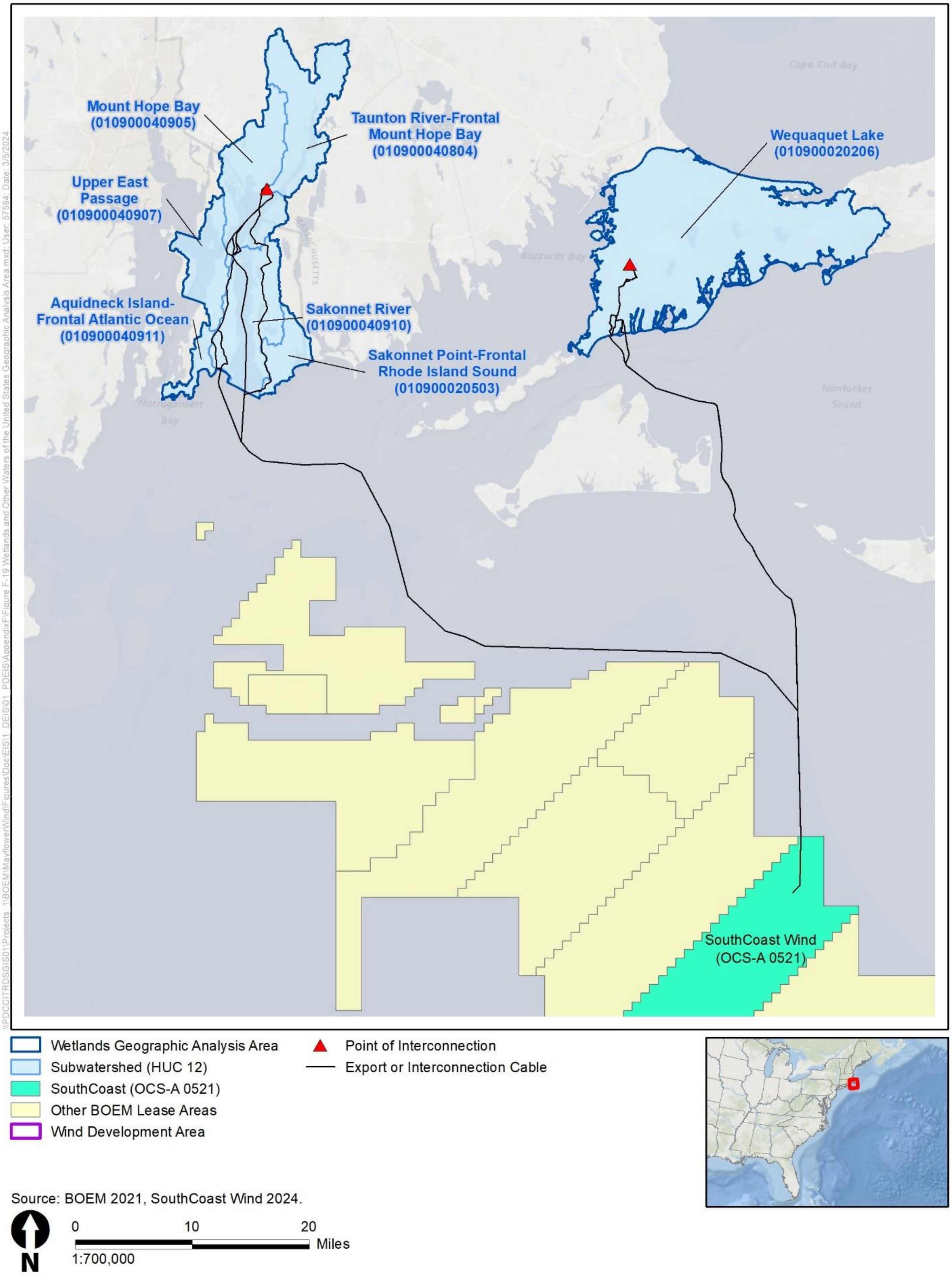


Figure 3.5.8-1. Wetlands geographic analysis area

The Brayton Point Onshore Project area lies within seven watersheds: Taunton River-Frontal Mount Hope Bay (HUC 10900040804), Mount Hope Bay (HUC 10900040905), Sakonnet River (HUC 10900040910), Sakonnet Point-Frontal Rhode Island Sound (HUC 010900020503), Upper East Passage (HUC 010900040907), Aquidneck Island-Frontal Atlantic Ocean (HUC 010900040911), and Wequaquet Lake (HUC 010900020206). According to MassGIS data (MassGIS 2017, 2020), freshwater wetlands are limited in the vicinity of the Brayton Onshore Project area and consist of a few ponds, coastal wetlands, and emergent wetlands. NWI data suggest that the Brayton Point intermediate landfall routes on Aquidneck Island in Portsmouth, Rhode Island, are adjacent to and potentially within estuarine wetlands, particularly Route Option 2 (USFWS 2021).

Wetlands are important features in the landscape that provide numerous beneficial services or functions. Wetlands protect drinking water, prevent storm damage, and provide fish, shellfish, and wildlife habitats. COP Volume 2, Table 6-28 (SouthCoast Wind 2024) provides a list of species associated with habitats in the Onshore Project area, including species that use wetland habitats. Wetlands also support commercial fishing, tourism, recreation, and educational opportunities. Coastal wetlands, like those found in the vicinity of the Onshore Project area, buffer uplands from storm damage by absorbing wave energy and reducing the height of storm waves. Wetland plants also bind the soil and help slow shoreline erosion (MassDEP 2022b).

As shown in Table 3.5.8-1, the geographic analysis area contains approximately 34,876 acres of wetlands according to state agency wetland data for Massachusetts and NWI wetland data for Rhode Island (MassGIS 2017, 2020; USFWS 2021). NWI wetland data for Falmouth are provided in Appendix B.

Table 3.5.8-1. Wetland communities in the geographic analysis area

Wetland Community	Acres (Massachusetts)	Acres (Rhode Island) [a]	Total	Percent of Total
Falmouth Onshore				
Barrier Beach System [b]	2,558	0	2,558	18.1%
Bog	54	0	54	0.4%
Cranberry Bog	862	0	862	6.1%
Deep Marsh	162	0	162	1.1%
Salt Marsh	6,431	0	6,431	45.6%
Shallow Marsh Meadow or Fen	624	0	624	4.4%
Shrub Swamp	1,316	0	1,316	9.3%
Tidal Flat	241	0	241	1.7%
Wooded Swamp Coniferous	258	0	258	1.8%
Wooded Swamp Deciduous	1,246	0	1,246	8.8%
Wooded Swamp Mixed Trees	347	0	347	2.5%
Falmouth Total	**14,099**	**0**	**14,099**	**100%**
Brayton Point Onshore [c]				
Barrier Beach System [b]	24	0	24	0.1%
Bog	46	0	46	0.2%
Cranberry Bog	36	0	36	0.2%
Deep Marsh	228	0	228	1.1%
Salt Marsh	246	3,179	3,425	16.5%
Shallow Marsh Meadow or Fen	527	963	1,490	7.2%
Shrub Swamp	761	0	761	3.7%
Tidal Flat	13	0	13	0.1%
Wetland	50	0	50	0.2%
Wooded Swamp	23	9,917	9,940	47.8%
Wooded Swamp Deciduous	4,359	0	4,359	21.0%
Wooded Swamp Mixed Trees	405	0	405	1.9%
Brayton Point Total	**6,718**	**14,059**	**20,777**	**100%**
Geographic Analysis Area Total	**20,817**	**14,059**	**34,876**	**-**

[a] Rhode Island data are based on NWI. NWI wetland categories include estuarine and marine wetlands, freshwater emergent wetlands, and freshwater forested/scrub wetlands, which were synced to MassGIS' salt marsh, shallow marsh or fen, and wooded swamp wetland categories, respectively.
[b] Barrier Beach System wetland types include coastal beach, coastal dune, marsh, open water, salt marsh, shrub swamp, wooded swamp coniferous, wooded swamp deciduous, and wooded swamp mixed trees.
[c] Wetland types and acreages reported for Brayton Point include the intermediate landfall on Aquidneck Island in Portsmouth, Rhode Island.
Sources: MassGIS 2017, 2020; USFWS 2021.

3.5.8.2 Impact Level Definitions for Wetlands

The definitions of impact levels for wetlands are provided in Table 3.5.8-2. USACE, MassDEP, and RIDEM define wetland impacts differently than BOEM's due to requirements under CWA Section 404, the Massachusetts Wetlands Protection Act, and the Rhode Island Freshwater Wetlands Act (as summarized below).

Table 3.5.8-2. Definition of potential adverse and beneficial impact levels for wetlands and other waters of the United States

Impact Level	Definition of Potential Adverse Impact Levels	Definition of Potential Beneficial Impact Levels
Negligible	Either no effect or no measurable impacts.	Either no effect or no measurable impacts.
Minor	Small, measurable, adverse impacts to local wetland or other waters of the United States extent, quality, or function; localized; could be avoided with mitigation; impacts that do occur are short-term or temporary in nature; complete recovery anticipated.	Small and measurable effects that would increase the extent, quality, and functions of wetlands or other waters of the United States in the proposed Project Area.
Moderate	Notable and measurable adverse impacts to the extent, functions, or quality of wetlands or other waters of the United States could occur, and the affected resource would recover completely with remedial or mitigation activities within a specified time frame.	Notable and measurable effects comprising an increase in the extent, function, or quality of wetlands or other waters of the United States in the proposed Project Area.
Major	Measurable, long-term, and widespread (regional or population-level) adverse impacts to the extent, functions, or quality of wetlands or other waters of the United States could occur, and full recovery not anticipated even with remediation or mitigation.	Measurable and widespread (regional or population-level) increase in extent, function, or quality of wetlands or other waters of the United States.

Under CWA Section 404, USACE considers fill impacts that permanently convert a wetland to an upland as a permanent impact. Conversion of a wetland type may also be considered a permanent impact. Temporary impacts occur when fill is placed in wetlands but the wetlands are restored to preconstruction contours when construction activities are complete (e.g., stockpile, temporary access).

Under Massachusetts General Laws Chapter 131, Section 40 (Wetlands Protection Act) no one may "remove, fill, dredge, or alter" any wetland, floodplain, bank, land under a water body, land within 100 feet (31 meters) of a wetland, or land within 200 feet (61 meters) of a perennial stream or river (25 feet [8 meters]of a few urban rivers), without a permit (known as an Order of Conditions) from the local conservation commission that protects the wetland "interests" identified in the Wetlands Protection Act. The "interests" or values protected by the Wetlands Protection Act are flood control; prevention of storm damage; prevention of pollution; and protection of fisheries, shellfish, groundwater, public or private water supply, and wildlife habitat. The term "alter" is defined to include any destruction of vegetation, or change in drainage characteristics or water flow patterns, or any change in the water table or water quality. The wetland regulations prohibit most destruction of wetlands and naturally vegetated riverfront areas and require replacement of flood storage loss when floodplains are filled (MACC 2022).

Rhode Island Code of Regulations 250-RICR-150-15-1 define "alter" and "alteration" as the "act of changing the character of a freshwater wetland as a result of activities within or outside of the wetland. Such activities include but are not limited to the following: excavating; draining; filling; placing trash, garbage, sewage, road runoff, drainage ditch effluent, earth, rock, borrow, gravel, sand, clay, peat, or other materials or effluents upon; diverting water flows into or out of; diking; damming; diverting; clearing; grading; constructing in; adding to or taking from; or other activities that individually or cumulatively change the character of any freshwater wetland" (Rhode Island Department of State 2022).

3.5.8.3 Impacts of Alternative A – No Action on Wetlands

When analyzing the impacts of the No Action Alternative on wetlands, BOEM considered the impacts of ongoing activities, including ongoing non-offshore wind and ongoing offshore wind activities on the baseline conditions for wetlands. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities, as described in Appendix D*, Planned Activities Scenario*.

Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for wetlands described in Section 3.5.8.1, *Description of the Affected Environment and Future Baseline Conditions* would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities. Ongoing non-offshore wind activities in the geographic analysis area that may contribute to impacts on wetlands are generally associated with onshore development activities and climate change. Onshore construction activities and associated impacts are expected to continue at current trends and have the potential to affect wetlands through activities that can have permanent (e.g., fill placement) and short-term (vegetation removal) impacts on wetland habitat, water quality, and hydrology functions. All activities would be required to comply with federal, state, and local regulations related to the protection of wetlands by avoiding and minimizing impacts. If impacts could not be entirely avoided, mitigation would be anticipated to compensate for wetland loss. Climate change induced sea level rise in the geographic analysis area is also anticipated to continue to affect wetlands. Inundation and rising water levels would result in the conversion of vegetated areas into areas of open water, with a consequent loss of wetland functions associated with the loss of vegetated wetlands. Slowly rising waters on a gentle, continuously rising surface can result in wetlands migrating landward. In areas where slopes are not gradual or where there are other features blocking flow (e.g., bulkhead or surrounding developed landscape), wetland migration would be slowed or impeded. Rising coastal waters would also continue to cause saltwater intrusion, which occurs when saltwater starts to move further inland and creeps into freshwater/non-tidal areas. Saltwater intrusion would continue to change wetland plant communities and habitat (i.e., freshwater species to saltwater species), and overall wetland functions.

Ongoing construction of the Vineyard Wind 1 project (OCS-A 0501) and New England Wind (OCS- 0354 and OCS-A 0561) would install cable landfalls and associated onshore equipment in Barnstable, Massachusetts, in the geographic analysis area, contributing to impacts on wetlands associated with the primary IPFs of accidental releases and land disturbance. Impacts of ongoing construction of Vineyard Wind 1 and New England Wind would have the same type of impacts on wetlands that are described in *Cumulative Impacts of the No Action Alternative* for ongoing and planned offshore wind activities.

Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative in combination with other planned non-offshore wind activities and planned offshore wind activities (without the Proposed Action).

Planned non-offshore wind activities that may affect wetlands would primarily include increasing onshore construction (Appendix D). These activities may permanently (e.g., fill placement) and temporarily (e.g., vegetation removal) affect wetland habitat, water quality, and hydrology functions. All activities would be required to comply with federal, state, and local regulations related to the protection of wetlands by avoiding or minimizing impacts. If impacts could not be entirely avoided, mitigation would be anticipated to compensate for wetland loss.

Impacts on wetlands from other offshore wind projects may occur if onshore and nearshore activity from these projects overlaps with the geographic analysis area. The ongoing construction of the Vineyard Wind 1 and New England Wind projects have cable landings and onshore components within the geographic analysis area with cable landfalls in Barnstable, Massachusetts, which is within the Wequaquet Lake watershed (HUC 010900020206) of the geographic analysis area.

The following sections summarize the potential impacts of ongoing and planned offshore wind activities on wetlands during construction, O&M, and decommissioning of the projects. BOEM expects offshore wind activities to affect wetlands through the following IPFs.

Accidental releases: During onshore construction of offshore wind projects in the geographic analysis area, oil leaks and accidental spills from construction equipment are potential sources of wetland water contamination. While many wetlands act to filter out contaminants, any significant increase in contaminant loading could exceed the capacity of a wetland to perform its normal water quality functions. Although degradation of water quality in wetlands could occur during construction, decommissioning, and to a lesser extent O&M, due to the small volumes of spilled material anticipated, these impacts would all be short term, until the source of the contamination is removed. Compliance with applicable state and federal regulations related to oil spills and waste handling would minimize potential impacts from accidental releases, including the Resource Conservation and Recovery Act, Department of Transportation Hazardous Material regulations, and implementation of a Spill Prevention, Control, and Countermeasure Plan. Impacts from accidental releases on wetlands would be minor because accidental releases would be small and localized and compliance with state and federal regulations would avoid or minimize potential impacts to wetland quality or functions.

Land disturbance: Construction of onshore components in the geographic analysis area is anticipated to require clearing, excavating, trenching, fill, and grading, which could result in the loss or alteration of wetlands, causing adverse effects on wetland habitat, water quality, and flood and storage capacity functions. Fill material permanently placed in wetlands during construction would result in the permanent loss of wetlands, including any habitat, flood and storage capacity, and water quality functions that the wetlands may provide. If a wetland were partially filled and fragmented or if wetland vegetation were trimmed, cleared, or converted to a different vegetation type (e.g., forest to herbaceous), habitat would be altered and degraded (affecting wildlife use), and water quality and flood and storage capacity functions would be reduced by changing natural hydrologic flows and reducing the wetland's ability to impede and retain stormwater and floodwater.

On a watershed level, any permanent wetland loss or alteration could reduce the capacity of regional wetlands to provide wetland functions. Short-term wetland impacts may occur from construction activity that crosses or is adjacent to wetlands, such as rutting, compaction, and mixing of topsoil and subsoil. Where construction leads to unvegetated or otherwise unstable soils, precipitation events could erode soils, resulting in sedimentation that could affect water quality in nearby wetlands, as well as alter wetland functions if sediment loads are high (e.g., habitat impacts from burying vegetation). The extent of wetland impacts would depend on specific construction activities and their proximity to wetlands. These impacts would occur primarily during construction and decommissioning; impacts during O&M would only occur if new ground disturbance was required, such as to repair a buried component.

BOEM anticipates that onshore project components from other offshore wind projects would likely be sited in disturbed areas (e.g., along existing roadways), which would avoid and minimize wetland impacts. In addition, BOEM expects the offshore wind projects would be designed to avoid wetlands to the extent feasible. Offshore wind projects would be required to comply with federal, state, and local regulations related to the protection of wetlands by avoiding or minimizing impacts. This would include compliance with the Massachusetts and Rhode Island National Pollutant Discharge Elimination System permits for stormwater discharges associated with construction activities and implementation of sediment controls and a Stormwater Pollution Prevention Plan to avoid and minimize water quality impacts during onshore construction. In-wetland work could require some or all of the following authorizations: CWA Section 404 permit from USACE, Section 401 Water Quality Certification from RIDEM or MassDEP, and additional RIDEM or MassDEP wetland permits if applicable. Work within 100 feet of wetlands in Massachusetts may also require MassDEP wetland permits pursuant to Massachusetts General Laws Chapter 131, Section 40 (Wetlands Protection Act). If impacts could not be avoided or minimized, mitigation could be anticipated for projects to compensate for lost wetlands. Overall, impacts from land disturbance on wetlands are anticipated to be moderate.

Conclusions

Impacts of the No Action Alternative: Under the No Action Alternative, wetlands would continue to follow current regional trends and respond to IPFs introduced by ongoing activities. Land disturbance from onshore construction periodically would cause short-term and permanent loss of wetlands. All activities would be required to comply with federal, state, and local regulations related to the protection of wetlands by avoiding or minimizing impacts. If impacts could not be entirely avoided or minimized, mitigation would be anticipated for projects to compensate for lost wetlands. BOEM anticipates that the No Action Alternative would result in **moderate adverse** impacts on wetlands.

Cumulative Impacts of the No Action Alternative: Under the No Action Alternative, existing environmental trends and ongoing activities would continue, and wetlands would continue to be affected by natural and human-caused IPFs. Planned activities would contribute to wetland impacts from the same IPFs. All activities would be required to comply with federal, state, and local regulations related to the protection of wetlands, thereby avoiding or minimizing impacts. If impacts could not be entirely avoided, compensatory mitigation would be anticipated for projects that result in permanent impacts. Therefore, BOEM anticipates the cumulative impacts of the No Action Alternative would be **moderate adverse**. Offshore wind activities are expected to contribute to the impacts through land disturbance and accidental releases, although the majority of these IPFs would be attributable to non-offshore wind ongoing activities.

3.5.8.4 Relevant Design Parameters and Potential Variances in Impacts

This EIS analyzes the maximum-case scenario; any potential variances in the proposed Project build-out as defined in the PDE would result in similar or lesser impacts than those described in the sections below. The following proposed PDE parameters (Appendix C, *Project Design Envelope and Maximum-Case Scenario*) would influence the magnitude of the impacts on wetlands:

- The sea-to-shore transition and landfall site variants in the Onshore Project area.
- Onshore export cable route and onshore substation site variants in the Onshore Project area.

An onshore export cable route with less wetlands in or adjacent to the right-of-way would have less potential for direct and indirect impacts on wetlands.

SouthCoast Wind has committed to measures to minimize impacts on wetland resources. SouthCoast Wind would implement BMPs to avoid, control, and address accidental releases and place construction mats to minimize soil disturbance in any wetland areas that cannot be avoided or are required to be temporarily crossed (COP Volume 2, Section 16; SouthCoast Wind 2024).

3.5.8.5 Impacts of Alternative B – Proposed Action on Wetlands

The Proposed Action could affect wetlands through the following IPFs.

Accidental releases: Onshore construction activities would require heavy equipment use and HDD activities, and potential spills could occur as a result of an inadvertent release from the machinery or during refueling activities. SouthCoast Wind would develop and implement a Project-specific SPCC plan to minimize impacts on water quality (prepared in accordance with applicable regulations such as the Massachusetts Oil and Hazardous Material Release Prevention Act and the Rhode Island Oil Pollution Prevention and Control Act). In addition, all wastes generated onshore would comply with applicable federal regulations, including the Resource Conservation and Recovery Act and the Department of Transportation Hazardous Material regulations. Therefore, BOEM anticipates the Proposed Action alone would result in minor and temporary impacts on wetlands as a result of releases from heavy equipment during construction and other cable installation activities.

Land disturbance: Construction impacts on wetlands and related functions would be similar to those described in Section 3.5.8.3, *Impacts of Alternative A – No Action on Wetlands*. Much of the proposed onshore Project components have been sited in areas that are previously disturbed or undergoing active management. The underground portion of the onshore export cable routes would be largely located in existing paved public roadway. The primary wetland impacts under the Proposed Action would be excavation, rutting, compaction, mixing of topsoil and subsoil, and potential alteration due ground disturbance associated with construction activities for the proposed onshore export cable routes. Based on MassGIS wetland data and the extent of the potential ground disturbance, there would be no wetland impact for the Brayton Point onshore Project components in Massachusetts and very little impact for the Falmouth onshore Project components (Table 3.5.8-3). Small areas of deep marsh (<0.01 acre) and wooded swamp deciduous wetland (0.06 acre) have the potential to be affected from cable installation at Falmouth; impacts on the wooded swamp deciduous wetland would likely be long term, because the cable corridor would need to be maintained as low vegetation during operations.[3]

Onshore export cable installation at the intermediate landfall on Aquidneck Island in Rhode Island would result in some wetland impacts. The impacts would be short term because these wetlands are not forested and restoration would be conducted in accordance with applicable federal and state wetland permit requirements. As shown in Table 3.5.8-3 and Figure 3.5.8-2, all four route options result in 0.012 acre of temporary wetland impacts. By using HDD, 2.1 acres of wetland impact would be avoided along Route Option 2a, and 0.1 acre of wetland would be avoided along Route Option 1 and Route Option 3. Approximately 0.9 acre of wetland would be avoided along Route Option 2b by using HDD. No permanent (e.g., permanent fill) or long-term wetland impacts are anticipated on affected wetlands on Aquidneck Island. SouthCoast Wind anticipates that wetland impacts would be avoided to the maximum extent practicable during the detailed design, engineering, and construction of the Project (COP Volume 2, Section 4.1.5.3; SouthCoast Wind 2024).

MassDEP-regulated adjacent transition areas may also be affected by clearing and soil disturbance. Water quality in wetlands could be affected by sedimentation from nearby exposed soils. SouthCoast

[3] As described in Chapter 2, Section 2.1.2, *Alternative B – Proposed Action,* Brayton Point is the preferred ECC for both Project 1 and Project 2, and Falmouth is the variant ECC for Project 2, which would be used if SouthCoast Wind is prevented from using Brayton Point for Project 2.

Wind would use erosion and sedimentation controls to avoid and minimize impacts during onshore construction (COP Volume 2, Table 16-1; SouthCoast Wind 2024). Dewatering also may be required during onshore construction. BMPs would be used during dewatering activities, such as temporary settling basins, filter bags, or temporary holding tanks. Dewatering activities would be short term, and water drawdown would be minimal. All earth disturbances from construction activities would be conducted in compliance with the Massachusetts and Rhode Island Pollutant Discharge Elimination System requirements for stormwater discharges associated with construction activities.

Table 3.5.8-3. Wetland impacts in the Onshore Project area – Proposed Action

Onshore Project Component	Wetland Community	Impact (Acres)	% Relative to Wetlands in GAA	Duration
Falmouth Onshore				
Onshore Export Cable Routes				
Worcester Avenue Route	N/A	0	0	N/A
Shore Street Route Eastern Option	N/A	0	0	N/A
Shore Street Route Western Option	N/A	0	0	N/A
Central Park Route	N/A	0	0	N/A
Lawrence Lynch to Cape Cod Aggregates Route	N/A	0	0	N/A
Paper Road – Thomas B Landers Road Deviation	N/A	0	0	N/A
Onshore Substation Locations				
Lawrence Lynch	N/A	0	0	N/A
Cape Cod Aggregates	N/A	0	0	N/A
Underground Transmission Route and Point of Interconnection				
Underground Transmission Route from Cape Cod Aggregates to POI	Deep Marsh	<0.01	<0.1	Short term (1–3 years)
	Wooded Swamp Deciduous	0.06	<0.1	Long term (> 5 years)
Point of Interconnection (Falmouth Switching Station)	N/A	0	0	N/A
Brayton Point Onshore				
Brayton Point Landing and Onshore Components [a]	N/A	0	0	N/A
Aquidneck Island Onshore Export Cables [b]				
Landing to Options Split (common to all route options below)	N/A	0	0	N/A
Route Option 1	Estuarine and Marine Wetland	0.012	<0.1	Short term (1–3 years)
Route Option 2a	Estuarine and Marine Wetland	0.012	<0.1	Short term (1–3 years)
Route Option 2b	Estuarine and Marine Wetland	0.012	<0.1	Short term (1–3 years)

Onshore Project Component	Wetland Community	Impact (Acres)	% Relative to Wetlands in GAA	Duration
Route Option 3	Estuarine and Marine Wetland	0.012	<0.1	Short term (1–3 years)

Source: MassGIS 2018a, 2018b, 2020; USFWS 2021.
GAA = geographic analysis area; N/A = not applicable.
Note: The disturbance area used to calculate the potential wetland impact areas from export cables is based on a 40-foot-wide corridor along the cable route, except for the cable route from Cape Cod Aggregates to POI, which is a 100-foot-wide corridor.
[a] Includes the Brayton Point Onshore landfall locations, underground transmission lines, and converter stations construction areas.
[b] SouthCoast Wind could use one of the three route options, with the Landing to Options Split segment common to all three. In addition, any wetland area along the cable corridor after the cable enters the HDD site is not considered an impact because the cable would be installed underneath any wetlands that may be along the cable corridor.

Figure 3.5.8-2. Wetlands along the Aquidneck Island onshore export cable routes

Any discharge of fill material, including the side cast of excavated material and the backfilling of excavated material, within regulated wetlands would require a CWA Section 404 permit from USACE. Additional authorizations for work in wetlands may include permits from MassDEP and/or RIDEM, and a Section 401 Water Quality Certification from MassDEP or RIDEM. Per CWA Section 404, SouthCoast Wind is required to take all appropriate and practicable steps to first avoid and minimize impacts on jurisdictional wetlands, and for those impacts that are unavoidable, propose compensatory mitigation to replace the loss of wetlands and associated functions. If necessary, SouthCoast Wind would identify compensatory mitigation based on the requirements of USACE and MassDEP or RIDEM. SouthCoast Wind would comply with all requirements of any issued permits. Because most wetlands would be avoided, and the wetland impacts that could occur are likely to be further avoided based on the width of the corridor used for the preliminary analysis in this EIS, BOEM anticipates wetland impacts would be mostly short term, localized, and small, and would not require any permanent fill or likely would not require compensatory mitigation. Therefore, potential adverse impacts on wetlands from construction activities are anticipated to be minor.

BOEM would not expect normal O&M activities to involve further wetland alteration. The onshore cable route and associated facilities generally have no maintenance needs unless a fault or failure occurs; therefore, O&M is not expected to affect wetlands. In the event of a fault or failure, impacts would be expected to be short term and negligible. Decommissioning of the onshore Project components would have similar impacts as construction.

Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned non-offshore wind activities, and other offshore wind activities. Ongoing and planned non-offshore wind activities related to onshore development activities would contribute to impacts on wetlands through the primary IPF of land disturbance and accidental releases. Temporary disturbance and permanent loss of wetland may occur as a result of offshore wind development. Impacts would likely be short term and minor due to the low risk and localized nature of the most likely spills, the use of an Oil Spill Response Plan for projects, and regulatory requirements for the protection of wetlands. If wetland alteration or loss is anticipated, it would likely be minimal, the overall scale of impacts is expected to be small, and any activities that would result from these impacts would be required to comply with federal, state, and local regulations related to the protection of wetlands by avoiding and minimizing impacts.

In the context of reasonably foreseeable environmental trends, the impacts on wetlands under the Proposed Action may add to the impacts of ongoing and planned land disturbance. Impacts due to onshore land use changes are expected to include a gradually increasing amount of wetland alteration and loss. The future extent of land disturbance from ongoing and planned non-offshore wind activities over the next 35 years is not known with as much certainty as the extent of land disturbance that would be caused by the Proposed Action, but based on regional trends is anticipated to be similar to or greater than that of the Proposed Action. If other future projects were to overlap the geographic analysis area or even be co-located (partly or completely) within the same ROW corridor that the Proposed Action would use, then the impacts of those future projects on wetlands would be of the same type as those of the Proposed Action alone; the degree of impacts may increase, although the location and timing of future activities would influence this. For example, repeated construction in a single ROW corridor would be expected to have less impact on wetlands than construction in an equivalent area of undisturbed wetland. All earth disturbances from construction activities would be conducted in compliance with the state Pollutant Discharge Elimination System General Permit for Stormwater Discharges from Construction Activities and implementation of sediment controls and an SWPPP to avoid and minimize water quality impacts during onshore construction. Any work in wetlands would require a CWA Section 404 permit from USACE and a Section 401 Water Quality Certification; any wetlands permanently lost would require compensatory mitigation.

Conclusions

Impacts of the Proposed Action: The Proposed Action may affect wetlands through short-term disturbance from cable installation activities in or adjacent to these resources. Considering the avoidance, minimization, and mitigation measures required under federal and state statutes (e.g., CWA Section 404), and that no permanent or long-term impacts on wetlands are anticipated, construction of the Proposed Action would likely have **moderate adverse** impacts on wetlands.

Cumulative Impacts of the Proposed Action: In the context of reasonably foreseeable environmental trends, BOEM anticipates that the cumulative impacts associated with the Proposed Action when combined with the impacts on wetlands from ongoing and planned activities including offshore wind would likely be **moderate adverse**. The Proposed Action would contribute to the cumulative impact rating primarily through short-term impacts on wetlands from onshore construction activities. Measurable impacts would be relatively small, and the resource would likely recover completely when the affecting agent (e.g., temporary construction activity) is gone and remedial or mitigating action is taken.

3.5.8.6 Impacts of Alternative C on Wetlands

Impacts of Alternative C: Under Alternative C, the export cable route to Brayton Point would be rerouted onshore to avoid sensitive fish habitat in the Sakonnet River. The onshore export cable route would be installed largely within existing road ROWs, increasing the total length of the onshore cable route by 9 miles (14 kilometers) under Alternative C-1, and by 13 miles (21 kilometers) under Alternative C-2. The types of impacts under Alternative C-1 and Alternative C-2 would be similar to those described for the Proposed Action, but slightly greater due to the larger area of land disturbance. Alternative C-1 east variant and C-1 west variant could each result in an additional 1 acre of wetland impact compared to the Proposed Action. Alternative C-2, which does not go through Aquidneck Island, would potentially result in 0.24 acre of wetland impact, which would be slightly less than the Proposed Action for Route Option 2a, Route Option 2b, and Route Option 3, but a slightly greater wetland impact than the Proposed Action for Route Option 1 (Table 3.5.8-3). These impact estimates are based on wetland mapping within the onshore export cable corridor (using a 40-foot-wide corridor) and includes some small area (<0.1 acre total) of forested/shrub wetland impacts along Alternative C-1 west variant and

Alternative C-2, which would be considered a long-term impact if the wetlands needed to be cleared. This is a small difference compared to the Proposed Action, because the Proposed Action would not affect any wooded wetlands on Aquidneck Island. Wetland impacts from land disturbance and maintenance would still remain limited, impacts would primarily occur in existing ROWs, mitigation measures would be implemented, and compliance with federal and state regulations (e.g., CWA Section 404) for protection of wetlands would be required. Trenchless crossing methods (e.g., HDD) may also be used that would further avoid impacts at stream or wetland crossings.

Cumulative Impacts of Alternative C: In context of reasonably foreseeable environmental trends, cumulative impacts of Alternative C would be similar to those described under the Proposed Action.

Conclusions

Impacts of Alternative C: Alternative C-1 and Alternative C-2 would have the same **moderate adverse** short-term impacts on wetlands as the Proposed Action, although there could be a very small area of wooded wetland that could be permanently cleared if not avoided. The overall impacts on wetlands would not be materially different because land disturbance would remain limited, and implementation of mitigation measures and regulatory compliance would minimize impacts related to onshore ground disturbance.

Cumulative Impacts of Alternative C: In context of reasonably foreseeable environmental trends, BOEM anticipates that the cumulative impacts associated with Alternative C would be the same as the Proposed Action, resulting in **moderate adverse** impacts on wetlands.

3.5.8.7 Impacts of Alternatives D (Preferred Alternative), E, and F on Wetlands

Impacts of Alternatives D, E, and F: The impacts of Alternatives D, E, and F on wetlands would be the same as the Proposed Action, because these alternatives differ only with respect to offshore components, and offshore components of the proposed Project have no potential impacts on wetlands.

Cumulative Impacts of Alternatives D, E, and F: In context of reasonably foreseeable environmental trends, cumulative impacts of Alternatives D, E, and F would be the same as described under the Proposed Action.

Conclusions

Impacts of Alternatives D, E, and F: The expected short-term **moderate adverse** impacts associated with the Proposed Action alone would not change under Alternatives D, E, and F because the alternatives only differ in offshore components, and offshore components would not contribute to impacts on wetlands.

Cumulative Impacts of Alternatives D, E, and F: In context of reasonably foreseeable environmental trends, BOEM anticipates that the cumulative impacts associated with Alternatives D, E, and F would be the same as the Proposed Action and result in **moderate adverse** impacts on wetlands.

3.5.8.8 Comparison of Alternatives

The minor impacts on wetlands under the Proposed Action would be the same for Alternatives D, E, and F because these alternatives would differ only with respect to offshore components, and offshore components of the proposed Project would have no potential impacts on wetlands and are outside of the wetlands geographic analysis area. Alternative C-1 could result in slightly greater wetland impacts than the Proposed Action, while Alternative C-2 could result in slightly greater or lesser impacts on wetlands compared to the Proposed Action, depending on the ultimate route selected for the Proposed Action on Aquidneck Island. The differences in impacts from Alternative C-1 and Alternative C-2 compared to the Proposed Action and other action alternatives would be small (1 acre or less of wetland impacts) and would not change the impact magnitude.

3.5.8.9 Proposed Mitigation Measures

No measures to mitigate impacts on wetlands have been proposed for analysis.

3.6 Socioeconomic Conditions and Cultural Resources

3.6.3 Demographics, Employment, and Economics

This section discusses potential impacts on demographics, employment, and economics from the proposed Project, alternatives, and ongoing and planned activities in the geographic analysis area for demographics, employment, and economics. The geographic analysis area, as shown on Figure 3.6.3-1, includes the counties where proposed onshore infrastructure and potential port cities are located, as well as the counties closest to the Wind Farm Area: Barnstable, Bristol, Dukes, Nantucket, Plymouth, and Essex County, Massachusetts; Bristol, Newport, Washington, and Providence County, Rhode Island; New London County, Connecticut; Baltimore County, Maryland; Nueces and San Patricio Counties, Texas; and Charleston County, South Carolina. These counties are the most likely to experience beneficial or adverse economic impacts from the proposed Project.

3.6.3.1 Description of the Affected Environment

Barnstable, Dukes, and Nantucket Counties, Massachusetts

Barnstable, Dukes, and Nantucket Counties are notable for the importance of coastal tourism and recreation to their economy and their high proportion of seasonal housing. Barnstable County is made up of the 15 municipalities that form the Cape Cod peninsula, while Dukes and Nantucket Counties cover the islands of Martha's Vineyard and Nantucket, respectively. Each of these areas has a significant seasonal population that, when considered, greatly increases the population density of the area.

Data on population, demographics, income, and employment for the state of Massachusetts and for Barnstable, Dukes, and Nantucket Counties are provided in Table 3.6.3-1 and Table 3.6.3-2. The population of Barnstable County declined by 1.8 percent from 2010 to 2019, while the population of Dukes and Nantucket Counties grew by 7.2 and 10.9 percent, respectively. Dukes and Nantucket Counties have the smallest population of any counties in Massachusetts. The population of Barnstable and Dukes Counties are older, on average, than the population of surrounding counties and Massachusetts as a whole, with a median age of 53.3 and 47.1, respectively, compared to the statewide median age of 39.5. These communities also have a higher percentage of residents aged 65 and up, with 29.8 percent in Barnstable County and 23.3 percent in Dukes County, compared to 16.2 percent in Massachusetts (U.S. Census Bureau 2022a). Unemployment rates in the three-county area are similar to those of Massachusetts as a whole. In 2020 unemployment was 5.8 percent in Nantucket County, 4.1 percent in Barnstable County, and 5.1 percent in Dukes County, as opposed to 5.1 percent in Massachusetts. Nantucket County's per capita income of $57,246 is greater than the statewide average of $45,555, while Barnstable and Dukes Counties are $47,315 and $43,994, respectively (U.S. Census Bureau 2022b).

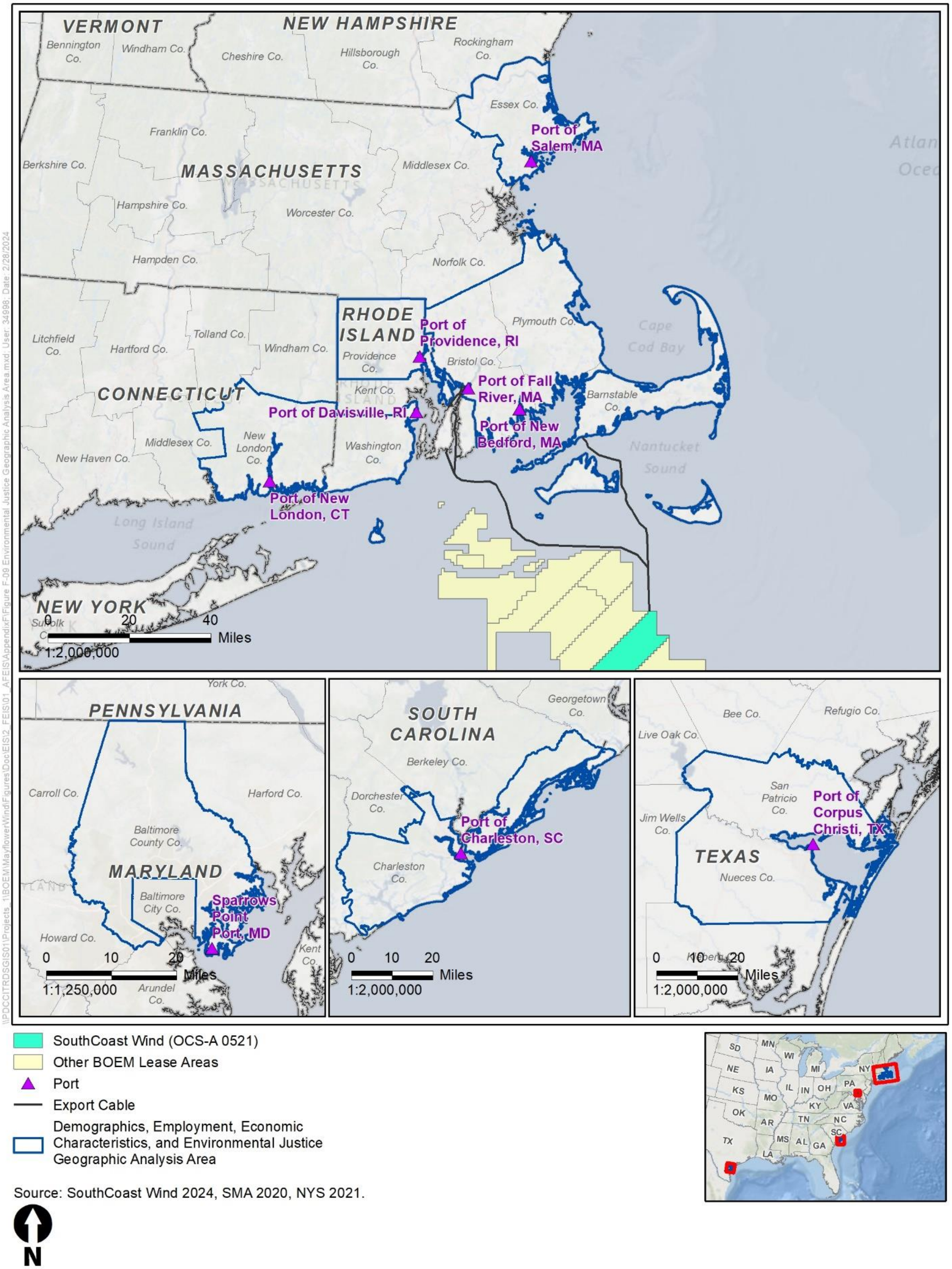


Figure 3.6.3-1. Demographics, employment, and economics geographic analysis area

Table 3.6.3-1. Demographic trends (2010–2019)

Jurisdiction	2010 Population	2019 Population	Population Change, percent (2010–2019)	2019 Percent Population 18–64 Years	2019 Percent of Population 65 or Older	2019 Median Age
Massachusetts	6,477,096	6,850,553	5.8%	64%	16.2%	39.5
Barnstable County	217,483	213,496	-1.8%	55%	29.8%	53.3
Bristol County	546,433	561,037	2.7%	63%	16.6%	41.0
Dukes County	16,155	17,312	7.2%	58%	23.3%	47.1
Nantucket County	10,069	11,168	10.9%	65%	14.6%	40.3
Plymouth County	490,784	515,303	5.0%	61%	17.6%	42.7
Essex County	735,642	783,676	6.5%	62%	16.7%	40.9
Rhode Island	1,056,389	1,057,231	0.1%	64%	16.8%	39.9
Bristol County	50,501	48,764	-3.4%	62%	19.4%	44.3
Newport County	83,253	82,801	-0.5%	61%	21.7%	45.2
Providence County	628,413	635,737	1.2%	64%	15.0%	37.4
Washington County	126,987	126,060	-0.7%	63%	20%	44.6
Connecticut	3,545,837	3,575,074	0.8%	62%	16.8%	41.0
New London County	272,360	267,390	-1.8%	63%	17.7%	41.4
Maryland	5,696,423	6,018,848	5.7%	63%	15.0%	38.7
Baltimore County	799,195	828,018	3.6%	62%	16.8%	39.4
South Carolina	4,511,428	5,020,806	11.3%	61%	17.2%	39.4
Charleston County	342,434	401,165	17.2%	64%	15.9%	37.8
Texas	24,311,891	28,260,856	16.2%	62%	12.3%	34.6
Nueces County	334,370	361,540	8.1%	61%	14.1%	35.5
San Patricio County	66,100	67,008	1.4%	58%	14.6%	35.5

Source: U.S. Census Bureau 2022a.

Table 3.6.3-2. Population, income, and employment data

Jurisdiction	Population (2019)	Population Density (persons per mi^2)	Per Capita Income (2020)	Total Employment (jobs, 2020)	Unemployment Rate (2020)
Massachusetts	6,850,553	648.42	45,555	3,615,725	5.1%
Barnstable County	213,496	163.47	47,315	105,798	4.1%
Bristol County	561,037	811.92	36,900	283,747	5.4%
Dukes County	17,312	35.26	43,994	8,902	5.1%
Nantucket County	11,168	106.06	57,246	6,419	5.8%

Jurisdiction	Population (2019)	Population Density (persons per mi^2)	Per Capita Income (2020)	Total Employment (jobs, 2020)	Unemployment Rate (2020)
Plymouth County	515,303	471.46	45,378	269,959	5.1%
Essex County	783,676	843.57	43,948	409,549	5.2%
Rhode Island	1,057,231	870.87	37,504	535,140	5.5%
Bristol County	48,764	1,083.64	48,321	24,636	3.4%
Newport County	82,801	263.70	50,514	41,154	5.8%
Providence County	635,737	1,552.47	32,739	316,776	5.9%
Washington County	126,060	382.81	44,325	64,854	5.9%
Connecticut	3,575,074	644.97	45,668	1,807,525	6.0%
New London County	267,390	346.36	40,995	132,072	5.3%
Maryland	6,018,848	619.95	43,352	3,076,280	5.2%
Baltimore County	828,018	1,383.72	41,089	420,275	5.0%
South Carolina	5,020,806	167.05	30,727	2,312,831	5.5%
Charleston County	401,165	436.95	43,141	207,897	3.7%
Texas	28,260,856	108.20	32,177	13,461,358	5.3%
Nueces County	361,540	430.82	28,078	163,776	5.8%
San Patricio County	67,008	96.65	26,714	28,244	5.0%

Source: U.S. Census Bureau 2022b.
mi^2 = square mile.

Barnstable, Dukes, and Nantucket Counties are notable for the importance of tourism and visitors to their economy and their high proportion of seasonal housing. Table 3.6.3-3 includes housing data for the geographic area of interest. In Massachusetts as a whole, approximately 4.4 percent of housing units are seasonally occupied, as compared to 38.3 percent of homes in Barnstable County, 59.7 percent of homes in Dukes County, and 63.7 percent of homes in Nantucket County. The median owner-occupied home value in Dukes and Nantucket Counties is significantly higher than the statewide average. The median values in Dukes and Nantucket Counties are $699,500 and $1,084,700, respectively, while the median home value across Massachusetts is $381,600 (U.S. Census Bureau 2022c).

Table 3.6.3-3. Housing data (2019)

Jurisdiction	Housing Units	Seasonal Vacant Units	Vacant Units (Non-Seasonal)	Non-Seasonal Vacancy Rate	Median Value (Owner-Occupied)	Median Monthly Rent (Renter-Occupied)
Massachusetts	2,897,259	127,398	152,364	5%	381,600	1,282
Barnstable County	163,557	62,643	6,591	4%	393,500	1,311
Bristol County	235,275	2,892	14,471	6%	299,800	901
Dukes County	17,902	10,681	456	3%	699,500	1,459
Nantucket County	12,345	7,860	772	6%	1,084,700	1,764
Plymouth County	207,003	10,514	9,029	4%	370,300	1,279
Essex County	313,956	5,236	11,466	4%	436,600	1,298
Rhode Island	468,335	17,478	40,368	9%	261,900	1,004
Bristol County	21,053	224	1,612	8%	358,100	1,037
Newport County	42,563	4,284	3,502	8%	387,900	1,285
Providence County	266,624	1,669	27,637	10%	248,500	989
Washington County	64,016	11,074	3,840	6%	343,000	1,133
Connecticut	1,521,199	29,669	106,093	7%	279,700	1,201
New London County	123,849	4,981	9,252	7%	246,800	1,144
Maryland	2,448,422	58,876	184,342	8%	314,800	1,392
Baltimore County	337,052	1,142	22,391	7%	261,500	1,302
South Carolina	2,286,826	128,239	236,725	10%	162,300	894
Charleston County	187,953	11,410	17,348	9%	315,600	1,190
Texas	10,937,026	247,358	998,021	9%	172,500	1,045
Nueces County	149,287	4,704	15,132	10%	138,700	1,017
San Patricio County	28,226	1,035	4,293	15%	122,100	975

Source: U.S. Census Bureau 2022c

Table 3.6.3-4 and Table 3.6.3-5include data on the industries where residents in these counties work. The industries that employ workers reflect recreation and tourism's importance to these counties. A greater proportion of residents in these counties work jobs in arts, entertainment, and recreation and accommodation and food services (11.7 percent in Barnstable County and 10.3 percent in Nantucket County) than in Massachusetts as a whole (8.7 percent). Table 3.6.3-6 and Table 3.6.3-7 contain data on at-place employment by industry in the geographic area of interest. A higher proportion of jobs in these counties are again in arts, entertainment, and recreation and accommodation and food services (8.5 percent in Barnstable County, 9.4 percent in Dukes County, and 7.3 percent in Nantucket County), as well as retail trade (11.2 percent in Barnstable County, 6.3 percent in Dukes County, and 11.2 percent in Nantucket County) than in Massachusetts as a whole (5.7 and 8.2 percent, respectively) (U.S. Census Bureau 2022d).

NOAA tracks economic activity dependent upon the ocean in its "Ocean Economy" data, which generally include, among other categories, commercial fishing and seafood processing, marine construction, commercial shipping, and cargo-handling facilities, ship and boat building, marine minerals, harbor and port authorities, passenger transportation, boat dealers, and coastal tourism and recreation. Tourism and recreation accounted for 86 percent of the overall Ocean Economy Gross Domestic Product (GDP) in Barnstable County, and 100 percent in Dukes and Nantucket Counties (NOAA 2022). This category includes recreational and charter fishing, as well as commercial ferry services based in Hyannis Harbor and Woods Hole, which provide service to Nantucket, Martha's Vineyard, and other locations. The Woods Hole, Martha's Vineyard, and Nantucket Steamship Authority generated over $104 million in revenue in 2018 with almost 24,000 trips and 3,055,347 passengers carried (Steamship Authority 2018).

The "living resource" sector of the Ocean Economy includes commercial fishing, aquaculture, seafood processing, and seafood markets. The living resource sector accounts for 2.6 percent of employment and 3.2 percent of the GDP of the U.S marine economy. Seafood markets are the largest producer in the living resources sector, accounting for 41.5 percent of the sector's GDP and accounting for the most employed workers in the sector (NOAA 2021). Although the number employed or self-employed in this sector in Barnstable, Dukes, and Nantucket Counties is small compared to recreation and tourism, local fishing fleets form an important part of the identity and tourist attraction of local communities. In Martha's Vineyard, the fishing industry has formed the Martha's Vineyard Fishermen's Preservation Trust, a nonprofit organization that raises funds to purchase fishing permits and lease their affiliated quota, or the right to catch a certain number of fish or shellfish, to local small-scale fishermen, in an effort to ensure a viable commercial fishing community (Martha's Vineyard Fishermen's Preservation Trust 2017).

Table 3.6.3-4. Employment of residents by industry: Massachusetts, Rhode Island, and Connecticut (2019)

Industry	Massachusetts	Barnstable County	Bristol County	Dukes County	Nantucket County	Plymouth County	Essex County	Rhode Island	Bristol County	Newport County	Providence County	Washington County	Connecticut	New London County
Agriculture, forestry, fishing and hunting, and mining	0.4%	1.0%	0.6%	2.8%	1.6%	0.6%	0.4%	0.4%	0.3%	1.0%	0.3%	1.0%	0.4%	0.6%
Construction	5.7%	9.8%	7.6%	14.7%	15.8%	7.6%	5.7%	5.5%	4.3%	6.8%	5.9%	7.4%	6.1%	5.9%
Manufacturing	8.8%	3.9%	11.0%	3.0%	2.6%	6.7%	10.6%	10.8%	8.8%	7.2%	11.2%	14.1%	10.5%	13.9%
Wholesale trade	2.2%	1.9%	3.2%	1.8%	2.6%	2.7%	2.1%	2.4%	1.9%	2.3%	2.3%	2.7%	2.4%	1.7%
Retail trade	10.3%	13.7%	12.8%	9.0%	12.7%	12.0%	11.0%	11.8%	9.7%	9.3%	12.2%	8.5%	10.5%	10.5%
Transportation and warehousing, and utilities	3.9%	3.8%	4.4%	5.6%	2.6%	4.8%	4.3%	4.0%	2.6%	3.1%	4.5%	3.3%	4.3%	4.0%
Information	2.3%	1.7%	1.6%	1.9%	0.6%	1.9%	2.1%	1.6%	1.6%	1.5%	1.5%	1.5%	2.0%	1.3%
Finance and insurance, and real estate and rental and leasing	7.3%	5.9%	5.8%	6.7%	7.3%	8.7%	6.9%	6.8%	8.1%	6.9%	6.3%	7.2%	9.1%	4.5%
Professional, scientific, and management, and administrative and waste management services	14.0%	12.1%	9.1%	13.3%	16.0%	11.4%	14.0%	10.3%	10.2%	12.6%	10.3%	11.1%	11.7%	9.0%

Industry	Massachusetts	Barnstable County	Bristol County	Dukes County	Nantucket County	Plymouth County	Essex County	Rhode Island	Bristol County	Newport County	Providence County	Washington County	Connecticut	New London County
Educational services, and health care and social assistance	28.2%	24.1%	27.0%	23.2%	18.1%	25.4%	25.3%	27.5%	34.2%	26.0%	27.3%	26.7%	26.5%	24.9%
Arts, entertainment, and recreation, and accommodation and food services	8.7%	11.7%	8.7%	7.9%	10.3%	9.3%	8.7%	10.4%	10.5%	12.8%	9.7%	7.6%	8.3%	14.3%
Other services, except public administration	4.5%	5.5%	4.2%	6.0%	5.1%	4.6%	4.7%	4.5%	3.8%	5.0%	4.9%	3.4%	4.6%	4.3%
Public administration	3.8%	4.9%	4.0%	4.1%	4.8%	4.3%	4.0%	4.0%	4.1%	5.5%	3.7%	5.5%	3.7%	5.2%

Source: U.S. Census Bureau 2022d.

Table 3.6.3-5. Employment of residents by industry: Maryland, South Carolina, and Texas (2019)

Industry	Maryland	Baltimore County	South Carolina	Charleston County	Texas	Nueces County	San Patricio County
Agriculture, forestry, fishing and hunting, and mining	0.4%	0.2%	1.0%	0.4%	3.4%	3.0%	6.4%
Construction	7.6%	6.3%	7.4%	8.4%	9.3%	11.4%	16.0%
Manufacturing	5.2%	6.2%	16.6%	7.3%	10.0%	7.5%	10.0%
Wholesale trade	2.0%	2.5%	2.8%	2.8%	3.3%	2.6%	2.9%
Retail trade	7.4%	8.5%	9.9%	8.9%	9.8%	10.2%	8.2%
Transportation and warehousing, and utilities	5.0%	5.5%	5.8%	4.5%	6.4%	5.3%	6.5%
Information	2.2%	2.0%	1.8%	2.2%	1.8%	1.4%	0.7%
Finance and insurance, and real estate and rental and leasing	6.8%	9.2%	6.6%	7.2%	7.5%	6.3%	5.4%
Professional, scientific, and management, and administrative and waste management services	16.8%	14.3%	10.3%	16.2%	11.8%	8.8%	7.7%
Educational services, and health care and social assistance	22.1%	25.5%	21.3%	22.8%	20.9%	22.3%	21.0%
Arts, entertainment, and recreation, and accommodation and food services	5.7%	5.4%	6.9%	10.5%	6.4%	9.1%	6.3%
Other services, except public administration	4.9%	4.2%	4.3%	4.2%	4.4%	4.7%	3.0%
Public administration	13.7%	10.2%	5.5%	4.7%	4.9%	7.4%	5.9%

Source: U.S. Census Bureau 2022d.

Table 3.6.3-6. At-place employment by industry: Massachusetts, Rhode Island, and Connecticut (2019)

Industry	Massachusetts	Barnstable County	Bristol County	Dukes County	Nantucket County	Plymouth County	Essex County	Rhode Island	Bristol County	Newport County	Providence County	Washington County	Connecticut	New London County
Agriculture, forestry, fishing and hunting, and mining	0.3%	0.6%	0.5%	3.5%	0.6%	0.6%	0.4%	0.4%	0.1%	0.6%	0.3%	1.0%	0.4%	0.7%
Construction	6.3%	11.6%	8.6%	15.7%	16.3%	8.9%	6.2%	5.9%	4.5%	6.6%	6.4%	6.1%	6.5%	6.3%
Manufacturing	11.2%	5.2%	14.0%	2.4%	2.0%	8.4%	13.4%	13.7%	11.5%	9.1%	14.0%	10.5%	13.3%	18.5%
Wholesale trade	2.6%	2.4%	4.0%	0.8%	3.1%	3.3%	2.5%	3.0%	2.5%	2.8%	2.9%	2.2%	2.9%	2.0%
Retail trade	8.2%	11.2%	10.6%	6.3%	11.2%	9.2%	8.7%	10.0%	7.9%	8.5%	10.2%	10.8%	8.4%	8.7%
Transportation and warehousing, and utilities	4.2%	4.2%	4.8%	4.9%	3.2%	5.3%	4.6%	4.2%	2.3%	3.2%	4.6%	3.0%	4.6%	4.3%
Information	2.6%	1.9%	1.8%	1.5%	0.8%	2.3%	2.6%	1.7%	1.7%	1.7%	1.5%	1.4%	2.2%	1.5%
Finance and insurance, and real estate and rental and leasing	9.0%	6.9%	7.3%	8.1%	9.1%	10.8%	8.3%	8.4%	9.9%	8.0%	7.9%	5.9%	11.3%	5.5%
Professional, scientific, and management, and administrative and waste management services	15.4%	12.6%	9.7%	14.5%	16.0%	12.4%	14.8%	10.6%	10.9%	13.9%	10.6%	10.4%	12.4%	9.9%
Educational services, and health care and social assistance	25.9%	23.5%	24.8%	22.6%	19.3%	23.3%	23.4%	26.0%	33.7%	24.7%	25.9%	27.9%	24.3%	21.9%

Industry	Massachusetts	Barnstable County	Bristol County	Dukes County	Nantucket County	Plymouth County	Essex County	Rhode Island	Bristol County	Newport County	Providence County	Washington County	Connecticut	New London County
Arts, entertainment, and recreation, and accommodation and food services	5.7%	8.5%	5.3%	9.4%	7.3%	5.5%	5.7%	6.8%	6.7%	9.2%	6.7%	12.7%	5.4%	10.9%
Other services, except public administration	3.8%	5.0%	3.6%	4.4%	3.7%	4.1%	4.2%	4.0%	2.6%	4.2%	4.2%	4.3%	3.8%	3.3%
Public administration	4.8%	6.4%	5.1%	5.7%	7.4%	5.7%	5.1%	5.4%	5.7%	7.5%	4.9%	3.9%	4.6%	6.5%

Source: U.S. Census Bureau 2022d.

Table 3.6.3-7. At-place employment by industry: Maryland, South Carolina and Texas (2019)

Industry	Maryland	Baltimore County	South Carolina	Charleston County	Texas	Nueces County	San Patricio County
Agriculture, forestry, fishing and hunting, and mining	0.5%	0.3%	1.0%	0.4%	3.0%	2.6%	1,635
Construction	6.9%	5.6%	6.8%	7.4%	8.6%	10.4%	3,951
Manufacturing	4.4%	5.3%	13.7%	6.3%	8.5%	6.3%	2,396
Wholesale trade	1.7%	2.2%	2.4%	2.3%	2.9%	2.2%	783
Retail trade	9.4%	10.4%	11.9%	10.2%	11.4%	11.5%	2,826
Transportation and warehousing, and utilities	4.8%	5.0%	5.1%	4.3%	5.9%	4.7%	1,695
Information	2.0%	1.9%	1.6%	2.1%	1.7%	1.3%	198
Finance and insurance, and real estate and rental and leasing	6.0%	7.8%	5.8%	6.6%	6.7%	5.8%	1,500
Professional, scientific, and management, and administrative and waste management services	15.7%	13.3%	10.2%	15.4%	11.5%	9.0%	2,144
Educational services, and health care and social assistance	23.7%	27.0%	21.8%	22.6%	21.6%	22.8%	6,568
Arts, entertainment, and recreation, and accommodation and food services	8.5%	8.2%	10.2%	13.3%	9.2%	11.8%	2,494
Other services, except public administration	5.6%	5.0%	5.2%	5.0%	5.2%	5.7%	921
Public administration	10.9%	8.1%	4.4%	4.0%	4.0%	5.9%	1,428

Source: U.S. Census Bureau 2022d.

Bristol, Essex, and Plymouth Counties, Massachusetts

Bristol County is a manufacturing center and has an ocean-based economy dominated by shipping, seafood processing, and commercial fishing. New Bedford in Bristol County is a nationally important commercial fishing center. Bristol County is more densely populated than Massachusetts as a whole and had lower per capita income and housing values. Manufacturing and wholesale trade jobs account for more than 18 percent of the county's at-place employment, compared to 13 percent statewide (U.S. Census Bureau 2022d). In 2019, living resources accounted for 80 percent of Bristol County's total Ocean Economy value (NOAA 2022). The unemployment rate in Bristol County was 5.4 percent in 2019, similar to the statewide rate (U.S. Census Bureau 2022b). The Port of New Bedford, a full-service port with well-established fishing and cargo handling industries, generated 14,429 jobs in 2018 (direct, indirect, and induced), mostly from commercial fishing and seafood processing activity (Martin Associates 2019). The seafood processing industry at New Bedford handles seafood landed at New Bedford Harbor, as well as seafood from other domestic and international sources. A total of 571 jobs were generated directly by non-seafood cargo and recreational boating activity (ferries, water taxis, and marinas). An additional 26,499 related jobs were generated by downstream logistics operations in seafood processing, after the seafood leaves the port processing operations and cold storage facilities (Martin Associates 2019).

Plymouth County is located in southeastern Massachusetts, just north of the Cape Cod peninsula. Unlike Barnstable, Dukes, and Newport Counties, Plymouth has a relatively small seasonal population, as only 5.1 percent of all housing units are seasonal units. However, tourism and recreation are still significant in the county, likely attributed to its position along the East Coast. In 2019, tourism and recreation accounted for 71 percent of Plymouth County's total Ocean Economy value (NOAA 2022).

Essex County is located in northeast Massachusetts and similar to previously discussed Massachusetts counties, contains a significant ocean-based economy and large coastline. Tourism and recreation accounted for 76 percent of the county's total Ocean Economy value in 2019 (NOAA 2022). However, only 1.7 percent of all housing units are seasonal (U.S. Census Bureau 2022c). From 2010 to 2019, the population of Essex County grew by 6.5 percent, and the median age in the county is 40.9, close to the statewide median age of 39.5. A higher proportion of jobs in Essex County are in the manufacturing sector (10.6 percent) than in Massachusetts as a whole (8.8 percent) (U.S. Census Bureau 2022d).

Newport, Bristol, Providence, and Washington Counties, Rhode Island

Similar to the described Massachusetts counties, Newport and Bristol Counties, located in southeast Rhode Island, are notably tied to tourism and recreation, which accounted for 56 and 77 percent of their overall Ocean Economy GDP, respectively (NOAA 2022). Both counties are home to a declining population that is older than that of Rhode Island. The 2019 median age was 45.2 in Newport County and 44.3 in Bristol County, compared to 39.9 across all of Rhode Island (U.S. Census Bureau 2022a). The median owner-occupied home value in both counties is also higher than the statewide average. The median value in Newport County is $387,900 and $358,100 in Bristol County, while the median home value across Rhode Island is $261,900 (U.S. Census Bureau 2022c). A higher proportion of jobs in

Newport County are in arts, entertainment, and recreation and accommodation and food services (9.2 percent) than in Rhode Island as a whole (6.8 percent) (U.S. Census Bureau 2022d).

Providence County is north of Newport and Bristol County. From 2010 to 2019, the population of Providence County grew by 1.2 percent, while the population of Rhode Island grew by only 0.1 percent (U.S. Census Bureau 2022a). The population of the county is younger than that of Rhode Island, with a median age of 37.4 (U.S. Census Bureau 2022a). The per capita income in Providence County is lower than that of the previously described Rhode Island counties at $32,739, while the unemployment rate of 5.9 percent is higher than the rest of the state (U.S. Census Bureau 2022b). A higher proportion of residents in Providence County work in retail trade (12.2 percent) than in Bristol or Newport County (9.7 percent and 9.3 percent, respectively) (U.S. Census Bureau 2022d).

Washington County is the southernmost county in Rhode Island, containing the island of Block Island and bordering the Block Island Sound at the southern coast of Rhode Island. The Port of Davisville is located in Washington County, near the mouth of Narragansett Bay. The population of Washington County shrank by 0.7 percent between 2010 and 2019, and in 2019 was on average older than the whole of Rhode Island (with a median age of 44.6, compared to Rhode Island's 39.9). Twenty percent of Washington County's population was over the age of 65 in 2019 (U.S. Census Bureau 2022a). Per capita income in Washington County is slightly higher than the state of Rhode Island's, but the unemployment rate was also slightly higher, at 5.9 percent (U.S. Census Bureau 2022b). Median home values and rental rates are higher than the state (U.S. Census Bureau 2022c). Tourism is an important business in Washington County, with the arts, entertainment, recreation, and accommodation and food services industries accounting for 12.7 percent of at-place employment in the county (U.S. Census Bureau 2022d).

New London, Connecticut

New London County, located in southeast Connecticut, borders the state of Rhode Island, and contains a large coastline situated along Long Island Sound. The city of New London sits directly on the coast and along the Thames River. From 2010 to 2019, the population of New London County decreased by 1.8 percent (U.S. Census Bureau 2022a). The median age in New London County is slightly older than the statewide median, and the proportion of the population that is age 65 or older (17.7 percent) is greater than that of the state (16.8 percent) (U.S. Census Bureau 2022a). A higher proportion of jobs in New London County are in manufacturing and arts, entertainment, and recreation and accommodation and food services, as well as manufacturing (14.3 and 13.9 percent, respectively), than in Connecticut as a whole (8.3 and 10.5 percent, respectively) (U.S. Census Bureau 2022d).

Baltimore County, Maryland

Located in northern Maryland, Baltimore County is home to the Port of Sparrows Point. The population of Baltimore County grew 3.6 percent between 2010 and 2019, slightly less than the population growth of the state of Maryland. The median age of Baltimore County is similar to that of Rhode Island, at 39.4 years (U.S. Census Bureau 2022a). The median income in Baltimore County is somewhat less than that of Maryland as a whole, while the unemployment rate is also slightly less, at 5.0 percent (U.S.

Census Bureau 2022b). At $261,500, the median home value in Baltimore County is less than the median home value in Maryland; median monthly rent is slightly less in the county than in the state, at $1,302 (U.S. Census Bureau 2022c). The educational services and health care and social assistance industry is somewhat bigger in Baltimore County than in Maryland, while the arts, entertainment, recreation, and accommodation and food services industries employ a lower proportion of people in Baltimore County than in Maryland as a whole (U.S. Census Bureau 2022d).

Charleston County, South Carolina

The Port of Charleston is in Charleston County, South Carolina. Between 2010 and 2019, the population in Charleston County grew 17.2 percent, the most of any county analyzed in the geographic analysis area. The median age in Charleston County is relatively young at 37.8 years and is slightly less than South Carolina as a whole (U.S. Census Bureau 2022a). Median income is much higher in Charleston County than South Carolina, at $43,141 versus $30,727. The unemployment rate is also lower in Charleston County at 3.7 percent, while the unemployment rate overall in South Carolina is 5.5 percent (U.S. Census Bureau 2022b). The median home value in Charleston County is nearly twice the median value in South Carolina, at $315,600. Median monthly rents are also higher (U.S. Census Bureau 2022c). Tourism is a large industry in the county, with arts, entertainment, and recreation, and accommodation and food services industries employing 13.3 percent of people in the county, higher than the proportion of those employed across the state (U.S. Census Bureau 2022d).

Nueces and San Patricio Counties, Texas

The Port of Corpus Christi is in Nueces and San Patricio Counties, Texas. The Port of Corpus Christi may be used to support Project construction. The populations of both counties grew between 2010 and 2019, with Nueces County growing 8.1 percent and San Patricio County growing 1.4 percent. Both counties are somewhat younger than the other counties in the geographic analysis area, with a median age of 35.5 years in each. The median age in both counties is slightly higher than in the state of Texas, the median age in which is 34.6 years (U.S. Census Bureau 2022a). The per capita income was slightly less in both counties than the per capita income in Texas. The unemployment rate in Nueces County was slightly higher than the state of Texas at 5.8 percent, while the unemployment rate in San Patricio County was slightly lower at 5.0 percent (U.S. Census Bureau 2022b). Both counties had somewhat high non-seasonal housing vacancy rates, with 10 percent in Nueces County and 15 percent in San Patricio County. The median home value and median monthly rent was slightly lower in San Patricio County than in Nueces County, and slightly lower in both than in the state of Texas (U.S. Census Bureau 2022c). Arts, entertainment, recreation, and accommodation and food services are important industries in Nueces County, employing 9.1 percent of residents. This is higher than both the state of Texas and San Patricio County’s rate of employment in the industry, at 6.4 percent and 6.3 percent, respectively. Educational services; health care and social assistance; construction; and retail trade are also strong industries in both counties (U.S. Census Bureau 2022d).

3.6.3.2 Impact Level Definitions for Demographics, Employment, and Economics

Definitions of impact levels are provided in Table 3.6.3-8.

Table 3.6.3-8. Impact level definitions for demographics, employment, and economics

Impact Level	Adverse or Beneficial	Definition
Negligible	Adverse	No impacts would occur, or impacts would be so small as to be unmeasurable.
	Beneficial	Either no effect or no measurable benefit.
Minor	Adverse	Impacts on the affected activity or geographic place would not disrupt the normal or routine functions of the affected activity or geographic place.
	Beneficial	Small but measurable benefit on demographics, employment, or economic activity.
Moderate	Adverse	The affected activity or geographic place would have to adjust somewhat to account for disruptions due to impacts of the Project.
	Beneficial	Notable and measurable benefit on demographics, employment, or economic activity.
Major	Adverse	The affected activity or geographic place would experience disruptions to a degree beyond what is normally acceptable.
	Beneficial	Large local or notable regional benefit to the economy as a whole.

3.6.3.3 Impacts of Alternative A - No Action on Demographics, Employment, and Economics

When analyzing the impacts of the No Action Alternative on demographics, employment, and economics, BOEM considered the impacts of ongoing activities, including ongoing non-offshore wind and ongoing offshore wind activities on the baseline conditions for demographics, employment, and economics. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities, as described in Appendix D, *Planned Activities Scenario*.

Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for demographics, employment, and economics of the geographic analysis area described in Section 3.4.2.1, *Description of the Affected Environment and Future Baseline Conditions*, would continue to follow current regional trends and respond to IPFs introduced by other ongoing activities. Tourism, recreation, and marine industries (e.g., fishing) would continue to be important components of the regional economy. Ongoing activities in the geographic analysis area that would contribute to impacts on demographics, employment, and economics include continued commercial shipping and commercial fishing; ongoing port maintenance and upgrades; periodic channel dredging; maintenance of piers, pilings, seawalls, and buoys; the use of small-scale, onshore renewable energy and climate change. Coasts are sensitive to sea level rise, changes in the frequency and intensity of storms, increases in precipitation, and warmer ocean temperatures. Sea level rise and increased storm frequency and severity could result in property or infrastructure damage, increase insurance cost, and reduce the economic viability of coastal communities. Impacts on marine life due to ocean acidification, altered habitats and migration patterns, and disease frequency would affect industries that rely on these species. The impacts of climate change are likely to, over time, worsen problems that coastal areas already face (Moser et al. 2014). The socioeconomic impact of ongoing activities varies depending on each activity. Activities that generate economic activity, such as port maintenance and channel dredging, would generally benefit the local economy by providing job opportunities and generating indirect economic activity from suppliers and other businesses that support activity along coastal areas. Conversely, ongoing activities that disrupt economic activity, such as climate change, may adversely affect businesses, resulting in impacts on employment and wages.

Offshore wind energy is anticipated to reduce the reliance and impact of fossil fuels (Section 3.4.1, *Air Quality)* which may affect employment within the fossil fuel industry in the region. According to the U.S. Energy Information Administration, in 2023, the majority of electricity in Massachusetts was generated by natural gas-fired power plants (U.S. Energy Information Administration 2024). According to the US Energy and Employment Report 2021, Massachusetts had about 31,000 jobs related to electric power generation (U.S. Department of Energy 2021). Nearly half of these jobs (about 15,000) were in solar electric generation, about 4,300 from natural gas generation, 1,400 from coal, and about 400 from oil and other fossil fuels (U.S. Department of Energy 2021). Only about 2,300 Massachusetts jobs were related to electricity generated by wind. As offshore wind projects including the Proposed Action and other activities in the geographic analysis area come on line, it is a reasonable assumption that there will be increased demand for jobs in the wind energy sector at the same time that jobs related to electric power generated by fossil fuels may be reduced. Ongoing offshore wind activities in the geographic analysis area that contribute to impacts on demographics, employment, and economics include ongoing construction of the Vineyard Wind 1 project (62 WTGs and 1 OSP) in OCS-A 0501, the South Fork project (12 WTGs and 1 OSP) in OCS-A 0517, and the Revolution Wind project (65 WTGs and two OSPs) in OCS-A 0486. Ongoing construction of the Vineyard Wind 1, South Fork, and Revolution Wind projects would affect demographics, employment, and economics through the IPFs of lighting, cable emplacement and maintenance, noise, port utilization, presence of structures, and land disturbance. Ongoing offshore wind activities would have the same type of impacts that are described in *Cumulative Impacts of the No Action Alternative* for ongoing and planned offshore wind activities, but the impacts would be of lower intensity.

Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative in combination with other planned non-offshore wind activities and planned offshore wind activities (without the Proposed Action).

Planned non-offshore wind activities that may affect demographics, employment, and economics include development of diversified, small-scale, onshore renewable energy sources; ongoing onshore development at or near current rates; continued increases in the size of commercial vessels; potential port expansion and channel-deepening activities; and efforts to protect against potential increased storm damage and sea level rise (see Appendix D, Section D.2, for a description of planned activities). Similar to ongoing activities, other planned non-offshore wind activities may result in beneficial socioeconomic impacts by generating economic activity that boosts employment, but there is also the potential for some adverse impacts.

Offshore wind could become a new industry for the Atlantic states and the nation. Although most offshore wind component manufacturing and installation capacity exists outside of the United States, some studies acknowledge that domestic capacity is poised to increase. This EIS uses available data, analysis, and projections to make informed conclusions on offshore wind's potential economic and employment impacts within the geographic analysis area.

AWEA estimates that the offshore wind industry will invest between $80 and $106 billion in U.S. offshore wind development by 2030, of which $28 to $57 billion will be invested within the United States. This figure depends on installation levels and supply chain growth, as other investment would occur in countries manufacturing or assembling wind energy components for U.S.-based projects. While most economic and employment impacts would be concentrated in Atlantic coastal states where offshore wind development will occur—there are over $1.3 billion of announced domestic investments in wind energy manufacturing facilities, ports, and vessel construction—there would be nationwide effects as well (AWEA 2020). The AWEA report analyzes base and high scenarios for offshore wind direct impacts, turbine and supply chain impacts, and induced impacts. The base scenario assumes 20 GW of offshore wind power by 2030 and domestic content increasing to 30 percent in 2025 and 50 percent in 2030, while the high scenario assumes 30 GW of offshore wind power by 2030 and domestic content increasing to 40 percent in 2025 and 60 percent in 2030. Offshore wind energy development would support $14.2 billion in economic output and $7 billion in value added by 2030 under the base scenario. Offshore wind energy development would support $25.4 billion in economic output and $12.5 billion in value added under the high scenario. It is unclear where in the U.S. supply chain growth would occur.

The University of Delaware projects that offshore wind power will generate 30 GW along the Atlantic coast through 2030. This initiative would require capital expenditures of $100 billion over the next 10 years (University of Delaware 2021). Although the industry supply chain is global and foreign sources would be responsible for some expenditures, more U.S. suppliers are expected to enter the industry.

Compared to the $14.2 to $25.4 billion in offshore wind economic output (AWEA 2020), the 2020 annual GDP for states with offshore wind projects (Connecticut, Massachusetts, Rhode Island, New York, New Jersey, Delaware, Maryland, Virginia, and North Carolina) ranged from $60.6 billion in Rhode Island to $1.72 trillion in New York (U.S. Bureau of Economic Analysis 2022) and totaled nearly $4.3 trillion. The $14.2 to $25.4 billion in offshore wind industry output would represent 0.3 to 0.6 percent of the combined GDP of these states.

AWEA estimates that in 2030, offshore wind would support 45,500 (base scenario) to 82,500 (high scenario) full-time equivalent (FTE) jobs nationwide, including direct, supply chain, and induced jobs. Most offshore wind jobs (about 60 percent) would be created during the temporary construction phase while the remaining 40 percent would be long-term O&M jobs. RODA estimated in 2020 that offshore wind projects would create 55,989 to 86,138 job years through 2030 in construction and 5,003 to 6,994 long-term jobs in O&M (Georgetown Economic Services 2020). These estimates are generally consistent with the AWEA study in total jobs supported, although the RODA study concludes that a greater proportion of jobs would be in the construction phase. The two studies conclude that states hosting offshore wind projects would have more offshore wind energy jobs, while states with manufacturing and other supply chain activities may generate additional jobs.

In 2020, employment in Massachusetts was 3.6 million (Table 3.6.3-2). While the extent to which there would be impacts in the geographic analysis area is unclear due to the geographic versatility of offshore wind jobs, a substantial portion of the planned offshore wind projects off the coast of Massachusetts and Rhode Island would likely be within commuting distance of ports in New Bedford, Fall River, and Salem, Massachusetts; New London, Connecticut; Davisville and Providence, Rhode Island; and other ports that would be used for offshore wind staging, construction, and operations.

The sections below summarize the potential impacts of ongoing and planned offshore wind activities on demographics, employment, and economics during construction, O&M, and decommissioning of the projects. Ongoing and planned offshore wind projects in the geographic analysis area that would contribute to impacts on demographics, employment, and economics include those projects within all or portions of OCS-A-0486 (Revolution Wind), OCS-A-0487 (Sunrise Wind), OCS-A-0500 (Bay State Wind), OCS-A 0501 (Vineyard Wind 1), OCS-A 0517 (South Fork Wind), OCS-A-0520 (Beacon Wind), OCS-A 0522 (Vineyard Wind Northeast), and OCS-A 0534 (New England Wind) (Appendix D, Table D2-1). BOEM expects offshore wind development to affect demographics, employment, and economics through the following primary IPFs.

Lighting: Offshore WTGs require aviation warning lighting that could have economic impacts in certain locations. Aviation hazard lighting from up to 901 WTGs could be visible from some beaches, coastlines, and elevated inland areas, depending on vegetation, topography, weather, and atmospheric conditions. Visitors may make different decisions on coastal locations to visit and potential residents may choose to select different residences because of nighttime views of lights on offshore wind energy structures. A University of Delaware study evaluating the impacts of visible offshore WTGs on beach use found that WTGs visible more than 15 miles from the viewer would have negligible impacts on businesses dependent on recreation and tourism activity (Parsons and Firestone 2018). In a subsequent study, 1,723 beachgoers were surveyed to determine the impact of WTGs, and the conclusion was that the further away the WTGs, the less of an impact. Nearly 70 percent of beachgoers said that WTGs 15 miles offshore would neither worsen nor increase their experience (Parsons et al. 2020). The majority of the WTG positions envisioned offshore of the geographic analysis area would be more than 15 miles (24.1 kilometers) from coastal locations with views of the WTGs and so impacts are anticipated to be negligible. These lights would be incrementally added over the construction period and would be visible for the operating lives of offshore wind activities. Distance from shore, topography, and atmospheric conditions would affect light visibility.

If implemented, ADLS would reduce the amount of time that WTG lighting is visible. Visibility would depend on distance from shore, topography, and atmospheric conditions. Such systems would likely reduce impacts on demographics, employment, and economics associated with lighting. Lighting for transit or construction could occur during nighttime transit or work activities. Construction of 12 offshore wind projects would occur within the Massachusetts/Rhode Island lease areas between 2023 and 2030, with a maximum of eight projects under construction concurrently (number of projects includes lease remainders; see Appendix D, Table D-2). Vessel lights would be visible from coastal businesses, especially near the ports used to support offshore wind construction (COP Volume 2, Section 8.2.2.1; SouthCoast Wind 2024).

Cable emplacement and maintenance: Cable installation for each project could temporarily cause commercial fishing vessels, static gear fishing vessels, and recreational vessels to relocate away from work areas and disrupt fish stocks, thereby reducing income and increasing costs during installation. Fishing vessels are not likely to access affected areas during active construction. About 9,832 acres (3,979 hectares) of seafloor disturbance would occur associated with offshore cable and interarray cable installation (Appendix D, Table D2-2). In the long term, concrete mattresses covering cables in hard-bottom areas could hinder commercial trawlers and dredgers (COP Volume 2, Section 11.2.3.2; SouthCoast Wind 2024). Assuming similar installation procedures as under the Proposed Action, the duration and range of impacts would be limited, and the disturbance to marine species important to recreational fishing and sightseeing would recover following the disturbance (COP Volume 2, Section 10.3.2; SouthCoast Wind 2024). Impacts of onshore cable installation would depend on the specific location but could temporarily disrupt beaches and other recreational coastal areas. Disruptions may result in conflict over other fishing grounds, increased operating costs for vessels, and lower revenue. Seafood processing and wholesaling businesses could also experience short-term reductions in productivity. Disruptions from new cable emplacement would have localized, short-term and minor impacts on demographics, employment, and economics. Maintenance is anticipated to have long-term intermittent and negligible impacts on demographics, employment, and economics.

Noise: Noise from O&M, pile driving, cable laying and trenching, and vessel traffic could result in temporary impacts on demographics, employment, and economics due to impacts on commercial/for-hire fishing businesses, recreational businesses, and marine sightseeing activities.

Assuming other offshore wind facilities generate vessel traffic similar to the vessel trips projected for the Proposed Action, construction of each offshore wind project would generate between 15 and 35 vessels operating at any given time (Section 3.6.6, *Navigation and Vessel Traffic*). Noise from vessel traffic during the maintenance and construction phases could affect species important to commercial/for-hire fishing, recreational fishing, and marine sightseeing activities (COP Volume 2, Section 6.8.2.1.2; SouthCoast Wind 2024). This noise may also make these facilities less attractive to fishing operators and recreational boaters (COP Volume 2, Section 11.2.1.1; SouthCoast Wind 2024). Similarly, noise from pile driving from offshore wind activities would affect fish populations that are crucial to commercial fishing and marine recreational businesses (COP Volume 2, Section 6.8.2.1.1; SouthCoast Wind 2024). These impacts would be greater if multiple construction activities occur in close spatial and temporal proximity. An estimated 920 foundations (WTGs and OSPs) would be installed within the Massachusetts and Rhode Island lease areas between 2023 and 2030.

Onshore construction noise could result in a short-term reduction of economic activity for businesses near installation sites for onshore cables or substations, temporarily inconveniencing workers, residents, and visitors. Noise would have intermittent, short-term, and negligible impacts on demographics, employment, and economics.

Port utilization: Offshore wind installation would require port facilities for berthing, staging, and loadout. Development activities would bolster port investment and employment, while also supporting jobs and businesses in supporting industries. Offshore wind development would also support planned expansions and modifications at ports in the geographic analysis area, including the ports of New London, Connecticut; Providence and Davisville, Rhode Island; New Bedford, Salem, and Fall River, Massachusetts; Sparrows Point Port, Maryland; Port of Charleston, South Carolina; and the Port of Corpus Christi marine terminal in Corpus Christi, Texas. While simultaneous construction or decommissioning (and, to a lesser degree, operation) activities for multiple offshore wind projects in the geographic analysis area could stress port capacity, it would also generate considerable economic activity and benefit the regional economy and infrastructure investment.

Port utilization would require a trained workforce for the offshore wind industry including additional shore-based and marine workers that would contribute to local and regional economic activity. Improvements to existing ports and channels would be beneficial to other port activity. Port utilization in the geographic analysis area would occur primarily during development and construction projects, anticipated to occur primarily between 2023 and 2030. Ongoing O&M activities would sustain port activity and employment at a lower level after construction.

Offshore wind activities and associated port investment and usage would have long-term, moderate beneficial impacts on employment and economic activity by providing employment and industries, such as marine construction, ship construction and servicing, and related manufacturing. The greatest benefits would occur during offshore wind project construction between 2023 and 2030. If offshore wind construction results in competition for scarce berthing space and port service, port usage could have short- to medium-term adverse impacts on commercial shipping.

Presence of structures: The addition of up to 920 offshore wind structures (WTGs and substations) with 1,247 acres (505 hectares) of foundation and scour protection and 414 acres (168 hectares) of offshore export cable hard protection would increase the risk of gear loss connected with cable mattresses and structures along the East Coast (Appendix D, Table D2-2). Fisheries using bottom gear may be permanently disrupted, which would increase economic impacts on the commercial/for-hire recreational fishing industries. These offshore facilities would also pose allision and height hazard risks, creating obstructions and navigational complexity for marine vehicles, which would impose fuel costs, time, and risk and require adequate technological aids and trained personnel for safe navigation. In the event of an allision, vessel damage and spills could result in both direct and indirect costs for commercial/for-hire recreational fishing.

Due to the locations of offshore wind lease areas, it is possible that some commercial fishing areas would be displaced. Because of this, fishermen are likely to switch to their next best fishing location.

These locations may involve lower catches per unit, catches of alternative species with different prices, or increased congestion, which would have its own effects, such as increased fishing costs among fishing fleets. In a study on the socioeconomic effects of offshore wind off the coast of Rhode Island and Massachusetts, Hoagland et al. (2015) found that losses associated with a reduction in commercial fishing may be distributed in unexpected ways across the coastal economy. Regional coastal economies are linked across onshore industry sectors and offshore activities, and impacts on commercial fishing would not just affect fishing fleets and related coastal businesses. The study's authors found that impacts may be most pronounced in areas that are not located in close proximity to the coastline (Hoagland et al. 2015), highlighting the potential for broad, regional socioeconomic impacts.

The potential for 920 offshore wind energy structures in the geographic analysis area could encourage fish aggregation and generate reef effects that attract recreational fishing vessels (COP Volume 2, Section 11.2.2.2; SouthCoast Wind 2024). Fish aggregation could increase human fishing activities, but this attraction would likely be limited to the minority of recreational fishing vessels that already travel as far from the shore as the wind energy facilities. Fish aggregation could result in broad changes in recreational fishing practices if these effects are widespread enough to encourage more participants to travel farther from shore.

The 1,247 acres (505 hectares) of hard coverage for offshore wind foundations could create foraging opportunities for harbor and gray seals, sea turtles, bats, northern gannets, loons, and peregrine falcons, possibly attracting private or commercial recreational sightseeing vessels. As a result, the presence of new habitat could increase economic activity associated with offshore sightseeing. New structures would be added intermittently between 2023 and 2030 and could benefit structure-oriented species as long as the structures remain (COP Volume 2, Section 6.8.2.4.2; SouthCoast Wind 2024).

As a result of fish aggregation and reef effects associated with the presence of offshore wind structures, there would be long-term impacts on commercial fishing operations and support businesses, such as seafood processing. The fishing industry is expected to be able to adapt its fishing practices over time in response to these changes. These effects could simultaneously provide new business opportunities, such as fishing and tourism.

The views of offshore WTGs could have impacts on certain businesses serving the recreation and tourism industry. Impacts could be adverse for particular locations if visitors and customers avoid certain businesses (i.e., hotels or rental dwellings) due to views of the WTGs; impacts could be neutral or beneficial if views do not affect visitor decisions or influence some visitors positively. Recreation and tourism economies and employment could be affected if visitors are attracted to or deterred from an area due to the presence of visible structures. Visible project components can have an adverse economic effect if the structure or activity is close to businesses that are highly dependent on an area's views or pristine setting. Depending on attitudes and sensitivities of tourist populations, the presence of WTGs, OSPs, or maintenance vessels may deter visitors who desire a pristine natural view. Visible structures could also have a positive impact on recreation and tourism economies. Research on wind farms in the United Kingdom and Europe indicate that there is potential for wind farms to be beneficial to tourism economies through wind-based tourism, such as boat tours of wind facilities (ICF 2012).

Studies in the United States of the Block Island Wind Farm have found beneficial impacts on tourism and recreation economies after the construction of the wind farm. A survey of tourists found no negative impact on trips taken to the Block Island Wind Farm after construction and found that, via stated preference, tourists would pay more for tourism and recreation experiences with views of wind turbines (Trandafir et al. 2020). A study found that after installation of the wind farm, catch of black sea bass and Atlantic cod increased as these species are attracted to the turbine structures, while there was no statistical difference in catch for most other fish species (Wilber et al. 2022). See also Section 3.6.8, *Recreation and Tourism*.

Overall, the presence of offshore wind structures would have continuous, long-term minor adverse impacts and minor beneficial impacts on demographics, employment, and economics. The commercial fishing industry is anticipated to be able to adjust to changes in fishing practices to maintain the viability of the industry in the presence of offshore wind structures. The presence of structures could also result in beneficial impacts for the recreational fishing and tourism industries.

Traffic: Offshore wind construction and decommissioning and, to a lesser extent, offshore wind operations would generate increased vessel traffic. This additional traffic would support increased employment and economic activity for marine transportation and supporting businesses and investment in ports. Assuming other offshore wind facilities generate vessel traffic similar to the projected Proposed Action vessel trips, construction of each offshore wind project would generate on average between 13 and 35 vessels operating at any given time. As stated previously, construction of 12 offshore wind projects could occur within the Massachusetts and Rhode Island lease areas between 2023 and 2030, with a maximum of eight projects under construction concurrently (Appendix D, Table D2-1). Increased vessel traffic would have continuous, beneficial impacts during all project phases, with minor impacts during construction and decommissioning.

Impacts of short-term, increased vessel traffic during construction could include marine congestion, delays at ports, and a risk for collisions between vessels. Increased vessel traffic would be localized near affected ports and offshore construction areas. Congestion and delays could increase fuel costs (i.e., for vessels forced to wait for port traffic to pass) and decrease productivity for commercial shipping, fishing, and recreational vessel businesses, whose income depends on the ability to spend time out of port. Collisions could lead to vessel damage and spills, which could have direct costs (i.e., vessel repairs and spill cleanup), as well as indirect costs from damage caused by spills. As a result of potential delays from increased congestion and increased risk of damage from collisions, vessel traffic is anticipated to have continuous, short-term, and minor impacts during construction and negligible impacts during operations.

Vessel traffic would occur among ports (outside the geographic analysis area) and offshore wind work areas. Most vessel traffic would travel to the WTG installation area with fewer vessels needed along the cable installation routes (COP Volume 1, Section 3.3.14; SouthCoast Wind 2024).

Land disturbance: Land disturbance could result in localized, temporary disturbances of businesses near cable routes and construction sites for substations and other electrical infrastructure, due to typical construction impacts, such as increased noise, traffic, and road disturbances. These impacts would be similar in character and duration to other common construction projects, such as utility installations, road repairs, and industrial site construction. Impacts on employment would be localized, temporary, and both beneficial (jobs and revenues to local businesses that participate in onshore construction) and adverse (lost revenue due to construction disturbances). Land disturbance impacts on demographics, employment, and economics would be minor.

Conclusions

Impacts of the No Action Alternative: Under the No Action Alternative, the geographic analysis area would continue to be influenced by regional demographic and economic trends. Ongoing non-offshore wind activities and offshore wind activities would continue to sustain and support economic activity and growth in the geographic analysis area based on anticipated population growth and ongoing development of businesses and industry. Tourism and recreation would continue to be important to the economies of the coastal areas, especially Barnstable, Dukes, and Nantucket Counties. Marine industries, such as commercial fishing and shipping would continue to be active and important components of the regional economy. Counties in the geographic analysis area would continue to seek to diversify their economies—including maintaining or increasing their year-round population—and protect environmental resources. BOEM anticipates that the No Action Alternative would result in **minor** adverse and **minor beneficial** impacts on demographics, employment, and economics.

Cumulative Impacts of the No Action Alternative: Under the No Action Alternative, ongoing and planned offshore wind and non-offshore wind activities would affect ocean-based employment and economics, driven primarily by the continued operation of existing marine industries, especially commercial fishing, recreation/tourism, and shipping; increased pressure for environmental protection of coastal resources; the need for port maintenance and upgrades; and the risks of storm damage and sea level rise. Increased investment in land and marine ports, shipping, and logistics capability is expected to result along with component laydown and assembly facilities, job training, and other services and infrastructure necessary for offshore wind construction and operations. Additional manufacturing and servicing businesses would result either in the geographic analysis area or other locations in the United States if supply chains develop as expected. While it is not possible to estimate the extent of job growth and economic output in the geographic analysis area specifically, there would be notable and measurable benefits to employment, economic output, infrastructure improvements, and community services, especially job training, because of offshore wind development.

Many of the jobs generated by offshore wind projects are temporary construction jobs. The combination of these jobs over multiple activities and projects will create notable benefits during the construction phases of these projects. This will particularly be the case as the domestic supply chain for offshore wind evolves over time. Offshore wind projects also support long-term O&M jobs (25–35 years); long-term tax revenues; long-term economic benefits of improved ports and other industrial land areas; diversification of marine industries, especially in areas currently dominated by recreation and tourism; and growth in a skilled marine construction workforce.

Offshore wind activities are expected to affect commercial and for-hire fishing businesses and marine recreational businesses (tour boats, marine suppliers) primarily through cable emplacement, noise and vessel traffic during construction, and the presence of offshore structures during operations. These IPFs would temporarily disturb marine species and displace commercial or for-hire fishing vessels, which could cause conflicts over other fishing grounds, increased operating costs, and lower revenue for marine industries and supporting businesses. The long-term presence of offshore wind structures would also lead to increased navigational constraints and risks and potential gear entanglement and loss.

BOEM anticipates that the cumulative impacts of the No Action Alternative would likely have **minor** adverse and **moderate beneficial** impacts on demographics, employment, and economics.

3.6.3.4 Relevant Design Parameters and Potential Variances in Impacts

This EIS analyzes the maximum-case scenario; any potential variances in the proposed Project build-out as defined in the PDE would result in impacts similar to or less than those described in the sections below. The following PDE parameters (Appendix C, *Project Design Envelope and Maximum-Case Scenario*) would influence the magnitude of the impacts on demographic, employment, or economic characteristics.

- Overall size of project (up to approximately 2,400 MW) and number of WTGs (up to 147).
- The extent to which SouthCoast Wind hires local residents and obtains supplies and services from local vendors.
- The port(s) selected to support construction, installation, and decommissioning and the port(s) selected to support O&M.
- The design parameters that could affect commercial fishing and recreation and tourism because impacts on these activities affect employment and economic activity.

The size of the Project would affect the overall investment and economic impacts; fewer WTGs would mean less materials purchased, fewer vessels, and less labor and equipment required. Beneficial economic impacts in the geographic analysis area would depend on the proportion of workers, materials, vessels, equipment, and services that can be locally sourced and the specific ports used by the Project.

SouthCoast Wind has committed to measures to minimize impacts on demographics, employment, and economics, which include, but are not limited to, maintaining a stakeholder engagement plan and encouraging the hiring of skilled and unskilled labor from the Project region (COP Volume 2, Table 16-1; SouthCoast Wind 2024).

3.6.3.5 Impacts of Alternative B - Proposed Action on Demographics, Employment, and Economics

The Proposed Action's beneficial impacts on demographics, employment, and economics depend on what proportion of workers, materials, vessels, equipment, and services can be locally sourced.

SouthCoast Wind's economic impact study estimates that the Proposed Action would support the following employment in Massachusetts alone in direct, indirect, and induced job-years:[1] 14,860 direct FTE job-years, 4,300 indirect FTE job-years, and 7,780 induced job-years, further defined by an estimated 530 FTE job-years[2] during development, 5,760 FTE job-years during construction, 20,330 FTE job-years (an annual average of 678 jobs) during operations, and 310 FTE job-years during decommissioning (COP Volume 2, Section 10.1.2.1, Table 10-8; SouthCoast Wind 2024).

The Proposed Action would generate employment during construction, installation, O&M, and decommissioning of the Project. The Proposed Action would support a range of positions such as engineers, environmental scientists, financial analysts, administrative personnel, various trade workers (such as electricians, technicians, steel workers, welders, and ship workers), as well as other construction jobs during construction and installation of the Proposed Action. O&M would create jobs for maintenance crews, substation and turbine technicians, and other support roles. The decommissioning phase would also generate professional and trade jobs and support roles. Therefore, all phases of the Proposed Action would lead to local employment and economic activity.

Assuming that conditions are similar to those of the Vineyard Wind 1 project, job compensation (including benefits) is estimated to average between $88,000 and $96,000 for the construction phase, with occupations including engineers, construction managers, trade workers, and construction technicians. O&M occupations would consist of turbine technicians, plant managers, water transportation workers, and engineers. A study from the New York Workforce Development Institute provided estimates of salaries for jobs in the wind energy industry that concur with the Vineyard Wind 1 project's projections. The expected salary range for trade workers and technicians ranges from $43,000 to $96,000, $65,000 to $73,000 for ships' crew and officers, and $64,000 to $150,000 for managers and engineers (Gould and Cresswell 2017).

The hiring of local workers would stimulate economic activity through increased demand for housing, food, transportation, entertainment, and other goods and services. A large number of seasonal housing units are available in the vicinity of the Project area. During the summer, competition for temporary accommodations may arise, leading to higher rents (COP Volume 2, Section 10.1.2.4; SouthCoast Wind 2024). However, this effect would be temporary during the active construction period and could be reduced if construction is scheduled outside the busy summer season. Permanent workers are expected to reside locally; there is adequate housing supply to accommodate the increase in the local workforce (Table 3.6.3-3).

SouthCoast Wind has committed to investments in community development and workforce training. SouthCoast Wind is encouraging the hiring of local personnel to fill the positions required for the various

---

[1] Direct employment refers to jobs created by the direct hiring of workers. Indirect employment refers to jobs created through increased demand for materials, equipment, and services. Induced employment refers to jobs created at businesses where offshore wind industry workers would spend their incomes. Job-years is an economic term that converts dollars spent into job equivalents based upon historical multipliers that consider factors, such as salary, overhead, and hours worked.
[2] A job-year is defined as one job held for 1 year.

preparation and construction activities. In 2022, SouthCoast Wind signed a Memorandum of Understanding (MOU) with North America's Building Trades Unions and the United Brotherhood of Carpenters regarding the onshore and offshore construction work for the delivery of the first 1,200 MW from the Lease Area. In March 2024, SouthCoast Wind renewed this MOU under the new ownership of Ocean Winds North America. The MOU includes commitments to create jobs for local and diverse workers and to comply with the labor requirements of the Inflation Reduction Act, including paying prevailing wages and using apprentices. SouthCoast Wind has further committed to making operations and maintenance jobs locally based in the state(s) that procure energy from the Project. Regarding job agreements with environmental justice communities, SouthCoast Wind has established a Protected Species Observer Training Program, where they are working to provide local Native American communities with cost-free training and all certifications to work as a Protected Species Observer.

Tax revenues for state and local governments would increase as a result of the Project. Equipment, fuel, and some construction materials would likely be purchased from local or regional vendors. These purchases would result in short-term impacts on local businesses by generating additional revenues and contributing to the tax base. Once the Project is operational, property taxes would be assessed on the value of the SouthCoast Wind facilities. The increased tax base during operations would be a long-term, beneficial impact on local governments in the Project area.

The Project would generate up to 2,400 MW of energy that would supply electric power to customers in the northeastern United States, including Massachusetts, Connecticut, and Rhode Island. The price of the power generated by the Project would be determined by offtake agreements, also known as power purchase agreements, negotiated between SouthCoast Wind and electric distribution companies, subject to each state's offshore wind procurement laws and regulations. The electric distribution companies that acquire the power from the Project would distribute and sell the power to their customers. While SouthCoast Wind's offtake agreements may influence the electricity prices paid by ratepayers in the states where the Project's power is purchased, the exact cost cannot be known at this time as electricity rates are affected by myriad factors including current demand for electricity, the mix and price of other generation sources (e.g., other offshore wind projects, natural-gas power plants), and other factors, including natural events like high summertime temperatures. In electricity markets where wind power is generated, the electricity cost for ratepayers may be variable, such as when the market is saturated with electricity due to windy seasons (Mills et al. 2018), or conversely, when there is less wind, the power demand may be higher, causing rates to increase.

Lighting: Both onshore and offshore structures emit light that could be visible from some beaches, coastlines, and elevated inland areas, depending on vegetation, topography, weather, and atmospheric conditions. Offshore, aviation hazard lighting on WTGs could affect employment and economics in these areas if the lighting discourages visits or vacation home rentals or purchases in coastal locations where the Proposed Action's WTG lighting would be visible. SouthCoast Wind proposes to implement an ADLS to automatically turn the aviation obstruction lights on and off in response to the presence of aircraft in proximity to the wind farm. Such a system may reduce the amount of time that the lights are on, thereby potentially minimizing the visibility of the WTGs from shore and related effects on the local economy. In summary, impacts related to structure lighting would have localized, long-term, and negligible impacts on demographics, employment, and economics.

The anticipated increase in vessel traffic would result in growth in the nighttime traffic of vessels with lighting. Lighting from vessels would occur during nighttime Project construction or maintenance. This lighting would be visible from coastal locations, especially near the ports used to support Proposed Action construction. Short-term vessel lighting is not anticipated to discourage tourist-related business activities and would not affect other businesses; therefore, the impact of vessel lighting would be short term and negligible.

Cable emplacement and maintenance: The Proposed Action's cable emplacement would generate vessel anchoring and dredging at the worksite, requiring recreational vessels to avoid and navigate around the worksites and resulting in short-term disturbance to species important to recreation and tourism, with potential adverse effects on employment and income. Interarray cable installation would require a maximum of three vessels (COP Volume 1, Table 3-21; SouthCoast Wind 2024). Offshore export cable installation would require a maximum of five vessels (COP Volume 1, Table 3-21; SouthCoast Wind 2024). While it is not specified how long vessels would be present at a given location, there would be at least one location where cable splicing is necessary, which could require a vessel to remain at the same location for several days (COP Volume 1, Section 3.3.7; SouthCoast Wind 2024).

The seafloor disturbance (associated with export cable and interarray cable installation), disruption of fish stocks, and concrete mattresses covering cables in hard-bottom areas could hinder commercial trawlers/dredgers, potentially reducing income and increasing costs for affected businesses over the long term. Cable installation would have localized, short-term, minor impacts on demographics, employment, and economics, while maintenance of the Proposed Action and other existing submarine cables would have intermittent, long-term, negligible impacts.

Noise: Noise from vessel traffic would affect commercial fishing businesses and recreational businesses due to impacts on species important to commercial/for-hire fishing, recreational fishing, and marine sightseeing activities as well as noise from maintenance and repair operations that make the wind energy facilities less attractive to fishing operators and recreational boaters (COP Volume 2, Section 11.2.1.2; SouthCoast Wind 2024). Noise from O&M activities would have localized, intermittent, long-term, negligible impacts on demographics, employment, and economics.

The estimated maximum of 149 foundations (WTGs and substations) would generate noise from pile driving, one of the most impactful noises on marine species, especially if multiple project construction activities occur in close spatial and temporal proximity. These disturbances would be temporary and localized and extend only a short distance beyond the work area. Pile driving could harm marine species or cause avoidance by commercial fish populations, which would, in turn, affect commercial and for-hire fishing, as well as recreational vessels that depend on these animals (COP Volume 2, Section 11.2.2.1; SouthCoast Wind 2024). Pile driving and associated noise would have localized, short-term, and minor impacts on demographics, employment, and economics.

Infrequent trenching from cable-laying activities would emit noise. This noise could temporarily disrupt commercial fishing, marine recreational businesses, and onshore recreational businesses. Noise from trenching and trenchless technology would affect marine life populations, which would in turn affect commercial and recreational fishing businesses. Impacts on marine life would also affect onshore recreational businesses due to noise near public beaches, parks, residences, and offices. The use of trenchless technology at natural and sensitive landfall locations where possible would minimize direct impacts (COP Volume 1, Section 2.2.2; SouthCoast Wind 2024). Cable laying and trenching would have localized, intermittent, short-term, and negligible impacts on demographics, employment, and economics.

Vessel noise could affect marine species relied upon by commercial fishing businesses, marine recreational businesses, recreational boaters, and marine sightseeing activities. Vessel traffic would occur between ports (outside the geographic analysis area) and offshore wind work areas. Most vessel traffic would travel to the WTG installation area, with fewer vessels needed along the cable installation routes (COP Volume 1, Section 3.3.14; SouthCoast Wind 2024). Noise from vessels would have short-term, intermittent, negligible impacts on demographics, employment, and economics.

Port utilization: Proposed Action activities at ports would support port investment and employment and would also support jobs and businesses in supporting industries and commerce. Several ports are indicated as possibly supporting proposed Project construction: New Bedford, Fall River, and Salem, Massachusetts; Davisville and Providence, Rhode Island; New London, Connecticut; Sparrows Point, Maryland; Charleston, South Carolina; Corpus Christi, Texas; as well as some international ports. These ports would require a trained workforce for the offshore wind industry including additional shore-based and marine workers that would contribute to local and regional economic activity.

The economic benefits would be greatest during construction when the most jobs and most economic activity at ports supporting the Proposed Action would occur. During operations, activities would be concentrated in Massachusetts, where the Project's onshore O&M facility is anticipated to be located, and in other ports that may support Project-related vessel traffic. The O&M facility would help to diversify the local economy by providing a source of skilled, year-round jobs. Overall, operation of the Proposed Action would generate an estimated 20,330 direct, indirect, and induced job-years (an annual average of 678 jobs) in Massachusetts while in operation, in addition to 900 job-years created elsewhere in the region, including Rhode Island (COP Volume 2, Section 10.1.2.1.2; SouthCoast Wind 2024). The Proposed Action would have a minor beneficial impact on demographics, employment, and economics from port utilization due to greater economic activity and increased employment at ports used by the Proposed Action.

Presence of structures: The Proposed Action would add up to 149 offshore wind structures (up to 147 WTGs and up to 5 OSPs) with foundation scour protection and offshore export cable hard protection, which could affect marine-based businesses (i.e., commercial and for-hire recreational fishing businesses, offshore recreational businesses, and related businesses) through entanglement and gear loss/damage, navigational hazard and risk of allisions, fish aggregation, habitat alteration, and space use conflicts. These structures may cause vessel operators to reroute, which would affect their fuel costs, operating time, and revenue. Due to the risk of gear entanglement, fisheries using bottom gear may be permanently disrupted, which would increase economic impacts on the commercial and for-hire recreational fishing industries. Marine-based businesses may be adversely affected due to the possible displacement of mobile species and the potential for WTGs to become an exclusion area for fishing. Shoreside support services, such as bait and ice shops, vessels and infrastructure, insurance and maintenance services, processing, markets, and domestic/international shipping services, are anticipated to experience impacts proportional to those felt by the fishing industry itself (BOEM 2017). As described in Section 3.6.1, *Commercial Fisheries and For Hire Recreational Fishing*, considering the small number of vessels and fishing activity that would be affected, the impacts on other fishing industry sectors, including seafood processors and distributers and shoreside support services, would be adverse, with the level of impact depending on the fishery in question. The presence of structures would have continuous, long-term, and negligible to minor impacts on demographics, employment, and economics.

Offshore wind structures could encourage fish aggregation and generate reef effects that attract recreational fishing vessels. These effects would only affect the minority of recreational fishing vessels that reach the wind energy facilities. This would have long-term, negligible benefits on demographics, employment, and economics. Proposed Action structures could increase economic activity associated with offshore sightseeing because these structures create foraging opportunities for harbor and gray seals, sea turtles, bats, northern gannets, loons, and peregrine falcons. These forms of marine life could attract private or commercial recreational sightseeing vessels (COP Volume 2, Section 10.3.2.2.2; SouthCoast Wind 2024). This would have long-term, negligible beneficial impacts on demographics, employment, and economics.

Views of WTGs could have impacts on businesses serving the recreation and tourism industry on Martha's Vineyard and Nantucket. The presence of offshore wind structures could affect shore-based activities (e.g., visiting the Nantucket Historic District), surface water activities, wildlife and sightseeing activities, diving/snorkeling, recreational fishing, and recreational boating (Section 3.6.8, *Recreation and Tourism*). The WTGs would be in open ocean approximately 20 nm (37 kilometers) from Nantucket and 26 nm (48 kilometers) from Martha's Vineyard. At maximum vertical extension, the blade tips of the WTGs (1,066.3 feet or 325.0 meters) would be theoretically visible to a viewer at a 5-foot (1.5-meter) eye level above the ocean surface or beach shoreline elevation at distances up to 42.8 miles (68.9 kilometers) on clear-day conditions. As described in Section 3.6.8, impacts of visible WTGs on recreation and tourist facilities and activities during O&M of the Proposed Action would be long term, continuous, and minor.

Stakeholders have raised questions regarding whether the Proposed Action would affect property values; any impacts on property values could also affect local property tax receipts. Hoen et al. (2013) analyzed housing prices from home sales occurring within 10 miles (16 kilometers) of onshore wind facilities in nine U.S. states and found no statistical evidence that home values were affected in the post-announcement/preconstruction or post-construction periods. The Massachusetts Clean Energy Center also commissioned a report—*Relationship between Wind Turbines and Residential Property Values in Massachusetts* (Atkinson Palombo and Hoen 2014)—to study if home values were affected by their proximity to onshore WTGs. The study analyzed 122,198 home sales occurring between 1998 and 2012 of homes within 5 miles (8 kilometers) of 41 Massachusetts wind turbines. Results of this study indicated that there were no effects on nearby home prices resulting from the development of a wind farm in a community. Brunner et al. (2024) found that onshore wind farms in the United States had temporary adverse impacts on property values within a limited distance (1–2 miles) and that wind farms further away did not adversely affect property values. A 2017 study found that when placed more than 8 miles (7 nm [13 kilometers]) from shore, there is a minimal effect on vacation rental values associated with offshore wind farms (Lutzeyer et al. 2017). A 2018 study also found that there was no impact on property values when the wind farm was located 5.6 miles (9 kilometers) offshore (Jensen et al. 2018). Dong and Lang (2022) found that the Block Island Wind Farm did not adversely affect property values on Block Island or on the Rhode Island mainland. Since the Project would be located a substantial distance from shore—with the closest WTGs 23 miles (37 kilometers) from Nantucket and 30 miles (48 kilometers) from Martha's Vineyard—any impacts on property values are expected to be negligible.

Traffic: The Proposed Action would generate vessel traffic in the Project area and to and from the ports supporting project construction, O&M, and decommissioning. SouthCoast Wind estimates that construction activity would generate on average between 15 and 35 vessels operating at any given time (refer to Section 3.6.6, *Navigation and Vessel Traffic*, for additional information regarding anticipated vessel traffic). The vessel traffic generated by the Proposed Action could result in temporary, periodic congestion within and near ports, leading to potential delays and increased risk of allision, collision, and spills, which would result in economic costs for vessel owners. As a result of potential delays from increased congestion and increased risk of damage from collisions, the Proposed Action would have continuous, short-term, and minor impacts during construction and negligible impacts during operations.

Land disturbance: Construction of the Proposed Action would require onshore cable installation and new substation/converter stations construction. During peak tourist season, construction-related impacts associated with land disturbance, including road construction in Falmouth (associated with the Falmouth POI) and Aquidneck Island (associated with the Brayton Point POI), could cause traffic delays and inconveniences to local businesses and residents.[3] Temporary blockage of some roads during installation activities may restrict access to some local areas, although it is unlikely that access to specific establishments would be completely inhibited. The impact would be greatest if the Cape Cod Aggregates substation site in the Falmouth Onshore Project area was selected as this would require temporary road closure and disruptions along 8.5 miles of road where the onshore cable would be installed. The disruptions in access would occur for a short period at any given location as installation of equipment progresses along the underground onshore export cables. Impacts would be temporary during construction and SouthCoast Wind has committed to implementing a Traffic Management Plan to minimize disruptions to residences and commercial establishments. The employment and economic impact of the Proposed Action caused by disturbance of businesses and potential revenue loss near the

[3] As described in Chapter 2, Section 2.1.2, *Alternative B – Proposed Action*, Brayton Point is the preferred ECC for both Project 1 and Project 2, and Falmouth is the variant ECC for Project 2, which would be used if SouthCoast Wind is prevented from using Brayton Point for Project 2.

onshore cable routes and substation and converter station sites would result in localized, short-term, minor impacts.

Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned non-offshore wind activities and other planned offshore wind activities. Between 2025 and 2031, WTG lighting from other offshore wind activities would be added to the geographic analysis area, some of which would be visible from the same locations as the Proposed Action's WTGs and could affect demographics, employment, and economics if lighting discourages tourism and recreation-based businesses. The Proposed Action would contribute an undetectable increment to the cumulative lighting impacts from ongoing and planned activities, which would be negligible. Cable emplacement from the Proposed Action and other ongoing and planned activities could hinder commercial fishing operations, potentially reducing income and increasing business costs. Because installation impacts would be short term and most cables would be buried such that they would not interfere with fishing operations, cumulative impacts are anticipated to be negligible. Construction of the Proposed Action would contribute to increased noise impacts during periods of simultaneous construction activity with other offshore wind projects (Appendix D, Table D2-1), potentially affecting commercial fish stock and other marine based businesses. While operational activity would overlap, noise impacts during operations would be far less than during construction. The Proposed Action would contribute an undetectable increment to the cumulative noise impacts on demographics, employment, and economics from ongoing and planned activities, which would be short term and negligible.

Other offshore wind energy activity would provide business activities at the same ports as the Proposed Action, as well as other ports in the geographic analysis area. Port investments are ongoing and planned in response to offshore wind activity. Maintenance and dredging of shipping channels are expected to increase, which would benefit other port users. In context of reasonably foreseeable environmental trends, the cumulative impact of the Proposed Action in combination with other ongoing and planned activities on port utilization would be long term and moderate beneficial.

Across the Massachusetts and Rhode Island lease areas, up to 1,069 offshore structures, 149 of which would be attributable to the Proposed Action, would affect employment and economics by affecting marine-based businesses. Presence of structures would have both beneficial impacts, such as by providing sightseeing opportunities and fish aggregation that benefit recreational businesses, and adverse effects, such as by causing fishing gear loss, navigational hazards, and viewshed impacts that could affect business operations and income. In context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the cumulative impacts from other ongoing and planned activities, which would be long-term and moderate due to impacts on commercial and for-hire recreational fishing, for-hire recreational boating, and associated businesses.

Increased vessel traffic from the Proposed Action and other ongoing and planned activities would produce demand for supporting marine services, with beneficial impacts on employment and economics during all Project phases, including minor to moderate beneficial impacts during construction and decommissioning and negligible beneficial impacts during operations. In context of reasonably foreseeable environmental trends, increased vessel traffic congestion and collision risk from the Proposed Action and other ongoing and planned activities would have long-term, continuous impacts on marine businesses during all project phases, with minor impacts during construction and decommissioning and negligible impacts during operations.

The exact extent of land disturbance associated with other projects would depend on the locations of landfall, onshore transmission cable routes, and onshore substations for offshore wind energy projects. The cumulative impact on land disturbance would be short term and minor due to the short-term and localized disruption of onshore businesses.

Conclusions

Impacts of the Proposed Action: BOEM anticipates that the Proposed Action would have negligible impacts on demographics in the geographic analysis area. While it is likely that some workers would relocate to the area because of the Proposed Action, this volume of workers would not be substantial compared to the current population and housing supply. The Proposed Action alone would affect employment and economics through job creation, expenditures on local businesses, tax revenues, grant funds, and support for additional regional offshore wind development, which would have minor beneficial impacts. Construction would have a minor beneficial impact on employment and economics due to jobs and revenue creation over the short duration of the construction period. The beneficial impact of employment and expenditures during O&M would have a modest magnitude over the 35-year duration of the Project. Although tax revenues and grant funds would be modest in magnitude, they also would provide a beneficial impact on public expenditures and local workforce and supply chain development for offshore wind. If the Proposed Action becomes decommissioned, the impacts on demographics, employment, and economics would be minor and beneficial due to the construction activity necessary to remove wind facility structures and equipment. After decommissioning, the Proposed Action would no longer affect employment or produce other offshore wind-related revenues.

While the Proposed Action’s investments in wind energy would largely benefit the local and regional economies through job creation, workforce development, and income and tax revenue, adverse impacts on individual businesses and communities would also occur. Short-term increases in noise during construction, cable emplacement, land disturbance, and the long-term presence of offshore lighting and structures would have negligible to minor adverse impacts on demographics, employment, and economics. The commercial fishing industry and other businesses that depend on local seafood production would experience impacts during construction. Overall, the impacts on commercial fishing and onshore seafood businesses would have minor impacts on demographics, employment, and economics for this component of the geographic analysis area’s economy. Although commercial fishing is a small component of the regional economy, it is important to the identity of local communities within the region. The IPFs associated with the Proposed Action alone would also result in impacts on certain recreation and tourism businesses that range from negligible to minor, with an overall minor impact on employment and economic activity for this component of the analysis area’s economy.

In summary, the Proposed Action would have **minor** adverse and **minor beneficial** impacts on demographics, employment, and economics.

Cumulative Impacts of the Proposed Action: BOEM anticipates that cumulative impacts on demographics, employment, and economics would be **minor** adverse and **moderate beneficial**. The moderate beneficial impacts primarily would be associated with the investment in offshore wind, job creation and workforce development, income and tax revenue, and infrastructure improvements, while the minor adverse effects would result from aviation hazard lighting on WTGs, new cable emplacement and maintenance, the presence of structures, vessel traffic and collisions during construction, and land disturbance. Impacts on commercial and for-hire recreational fishing are anticipated to be moderate but only one component of the overall impacts. Because they are not expected to disrupt normal demographic, employment, and economic trends, the overall impacts in the geographical analysis area likely would be minor.

3.6.3.6 Impacts of Alternative C on Demographics, Employment, and Economics

Impacts of Alternative C: Alternative C would result in similar but slightly greater impacts on demographics, employment, and economics compared to the Proposed Action, but the overall impact magnitudes would be the same. To avoid sensitive fish habitat in the Sakonnet River, the export cable route to Brayton Point under Alternative C would be rerouted onshore. The onshore export cable would be installed in trenches within existing road ROWs where feasible, including road shoulders and medians, and could potentially require pathways on private properties. The Alternative C-1 onshore export cable route would be installed primarily along Route 138, on Aquidneck Island, increasing the total length of the onshore cable route by approximately 9 miles (14 kilometers). The Alternative C-2 onshore export cable route would be installed primarily along Routes 77 and 177, in Little Compton and Tiverton, increasing the total length of the onshore cable route by approximately 13 miles (21 kilometers). Similar to the Proposed Action, onshore cable installation activities would result in temporary traffic delays, disruptions to business or residential access, noise, and related construction impacts, which could result in a short-term reduction of economic activity for businesses near installation sites for onshore cables, temporarily inconveniencing workers, residents, and visitors. Construction impacts would have intermittent and short-term impacts on demographics, employment, and economics.

Because the onshore cable routes would be longer than the Proposed Action, the number of businesses and residents affected would be greater and the duration of impacts from construction would be longer, with Alternative C-2 having the greatest impact. The overall onshore construction schedule would be longer than the Proposed Action due to the length of the routes, the larger number of private properties affected, and the cable routes' locations in coastal communities that are popular tourist destinations in the summer months, which may lead to seasonal limitations on construction. Both alternative cable routes would traverse along roadways through mostly rural residential neighborhoods and agricultural land, with some denser residential neighborhoods and local commercial businesses located along the cable routes in Portsmouth at the northern end of Aquidneck Island (Alternative C-1) and in Tiverton (Alternative C-2). The disruptions in access would occur for a short period at any given location as installation of equipment progresses along the onshore export cables. The same avoidance measures that SouthCoast Wind has proposed for the Proposed Action would apply for Alternative C, including implementing a Traffic Management Plan to minimize disruptions to local communities and developing a construction schedule to minimize effects to tourism related activities to the extent practicable (COP Volume 2, Table 16-1; SouthCoast Wind 2024). Because these impacts would be temporary, lasting only during installation activities, and with implementation of the avoidance measures proposed by SouthCoast Wind, impacts under Alternative C are anticipated to be localized, short term, and minor.

Cumulative Impacts of Alternative C: In the context of reasonably foreseeable environmental trends, cumulative impacts of Alternative C would be similar to those described under the Proposed Action.

Conclusions

Impacts of Alternative C: While the onshore cable route to Brayton Point would differ under Alternative C, the overall impact magnitudes are anticipated to be the same as those of the Proposed Action, which is anticipated to be **minor** adverse and **minor** beneficial on demographics, employment, and economics.

Cumulative Impacts of Alternative C: In context of reasonably foreseeable environmental trends, the cumulative impacts associated with Alternative C would be the same as under the Proposed Action and would be **minor** adverse and **moderate beneficial**.

3.6.3.7 Impacts of Alternative D (Preferred Alternative) on Demographics, Employment, and Economics

Impacts of Alternative D: Alternative D would result in a slight reduction in both adverse and beneficial impacts on demographics, employment, and economics compared to the Proposed Action, but the overall impact magnitudes would be the same. Under Alternative D, six fewer WTGs would be constructed than the Proposed Action to reduce impacts on foraging habitat adjacent to Nantucket Shoals. Construction of fewer WTGs would result in a shorter duration of noise impacts and less vessel traffic, which could reduce impacts on commercial and for-hire recreational fishing. Conversely, the reduced number of WTGs would also mean that the Project would generate less energy and would, therefore, result in slightly lower beneficial impacts associated with delivering a reliable supply of energy. Because Alternative D would produce less energy, it would also offset fewer GHG emissions from fossil-fueled power generation compared to the Proposed Action, further reducing beneficial impacts. A reduced number of WTGs would also generate less economic activity, which would reduce port utilization and result in lower expenditures in general. However, the change in these impacts would not change the overall impact rating compared to the Proposed Action.

Cumulative Impacts of Alternative D: In the context of reasonably foreseeable environmental trends, cumulative impacts of Alternative D would be similar to those described under the Proposed Action.

Conclusions

Impacts of Alternative D: Alternative D would result in slightly lower adverse impacts and slightly lower beneficial impacts compared to the Proposed Action, but would not change the overall impact level, which is anticipated to be **minor** adverse and **minor** beneficial on demographics, employment, and economics.

Cumulative Impacts of Alternative D: In context of reasonably foreseeable environmental trends, the cumulative impacts associated with Alternative D would be the same as under the Proposed Action—**minor** adverse impacts and **moderate beneficial** impacts.

3.6.3.8 Impacts of Alternatives E and F on Demographics, Employment, and Economics

Impacts of Alternatives E and F: Alternative E, which would involve installing a range of foundation types, and Alternative F, which would involve reducing the number of Falmouth offshore export cables from five to three, would not have measurable impacts on demographics, employment, and economics that are materially different from the impacts of the Proposed Action. While Alternative E-2 and Alternative E-3 would avoid foundations requiring pile driving, in contrast to Alternative E-1, which would only install piled foundations, any differences in noise impacts on commercial fisheries would be temporary and localized during foundation installation; therefore, the overall impact magnitude of Alternative E on demographics, employment, and economics would be the same and would not differ from the Proposed Action. Reducing the number of Falmouth offshore cables to minimize seabed impacts under Alternative F would result in no measurable differences in impacts compared to the Proposed Action.

Cumulative Impacts of Alternatives E and F: In the context of reasonably foreseeable environmental trends, the cumulative impacts of Alternatives E and F would be similar to those described under the Proposed Action.

Conclusions

Impacts of Alternatives E and F: The impacts of Alternatives E and F on demographics, employment, and economics would be about the same as those of the Proposed Action. Impacts would be **minor** adverse impacts and **minor beneficial**.

Cumulative Impacts of Alternatives E and F: In context of reasonably foreseeable environmental trends, the cumulative impacts associated with Alternative E and Alternative F would be the same as under the Proposed Action—**minor** adverse impacts and **moderate beneficial** impacts.

3.6.3.9 Comparison of Alternatives

The **minor** and **minor beneficial** impacts on demographics, employment, and economics under the Proposed Action would be the same for Alternatives C, D, E, and F. Alternatives D, E, and F only differ because of changes to offshore components, and the offshore components of the proposed Project would not contribute to significant impacts on demographics, employment, and economics. Alternative C would require rerouting the Brayton Point export cable onshore with two possible routes, Alternatives C-1 and C-2 and would increase the cable length in comparison to the Proposed Action by 9 and 13 miles, respectively; impacts are expected to be greater than the Proposed Action but the overall impact magnitude would remain the same.

In context of reasonably foreseeable environmental trends, the cumulative impacts associated with Alternatives C, D, E, and F when each is combined with the impacts of ongoing and planned activities would be the same as the Proposed Action—**minor** and **moderate beneficial**.

3.6.3.10 Proposed Mitigation Measures

No measures to mitigate impacts on demographics, employment, and economics have been proposed for analysis.

3.6 Socioeconomic Conditions and Cultural Resources

3.6.5 Land Use and Coastal Infrastructure

This section discusses potential impacts on land use and coastal infrastructure from the proposed Project, alternatives, and ongoing and planned activities in the geographic analysis area. The geographic analysis area, as shown on Figure 3.6.5-1, includes Barnstable and Bristol Counties in Massachusetts, Newport County in Rhode Island, Falmouth and Somerset in Massachusetts, and Portsmouth in Rhode Island, as well as municipal boundaries surrounding the ports that may be used for the Project. SouthCoast Wind proposes the use of ports in New Bedford, Fall River, and Salem, Massachusetts; Davisville and Providence, Rhode Island; New London, Connecticut; Sparrows Point, Maryland; Charleston, South Carolina; Corpus Christi, Texas; as well as some international ports.

3.6.5.1 Description of the Affected Environment

Within the geographic analysis area, land use is diverse, including water, marine, open land, conservation land, forest, parks, recreational, residential, business, industrial, urban, and agricultural land uses. The dominant land uses along the onshore cable corridors are commercial, residential, and public use. The Proposed Action includes one preferred ECC to Brayton Point and one variant ECC to Falmouth.[1] The Brayton Point onshore export cable corridors are in Somerset, Massachusetts, and on Aquidneck Island in Portsmouth, Rhode Island. Land uses in the vicinity of the Brayton Point route are urban development, non-urban developed, reserve, Narragansett Indian Lands, farmland, parks and open space, water bodies commercial, industrial, mixed use, residential, right-of-way, and tax exempt. The primary uses along the corridor are a combination of industrial, parks and open space, and urban (COP Volume 2, Figures 12-21 and 12-22; SouthCoast Wind 2024).

The Falmouth onshore export cable routes are in Falmouth, Massachusetts. Based on ArcGIS and MassGIS land use cover data, land uses in the vicinity of the Falmouth cable route are classified as agriculture, commercial, forest, industrial, mixed use, recreation, residential, right-of-way, and tax exempt (COP Volume 2, Figure 12-20; SouthCoast Wind 2024). Some recreational areas are located in proximity to the onshore export cable routes, including Falmouth Heights Beach, Surf Drive Beach, Worcester Avenue Park, Central Park, and Crescent Park; and the area includes a variety of residential development types (single family, multi-family, other) (COP Volume 2, Section 12.1.4.1 and Figure 12-20; SouthCoast Wind 2024). In Falmouth, Massachusetts, the dominant land uses are residential and open space (COP Volume 2, Figure 12-20; SouthCoast Wind 2024).

[1] As described in Chapter 2, Section 2.1.2, *Alternative B – Proposed Action,* Brayton Point is the preferred ECC for both Project 1 and Project 2, and Falmouth is the variant ECC for Project 2, which would be used if SouthCoast Wind is prevented from using Brayton Point for Project 2.

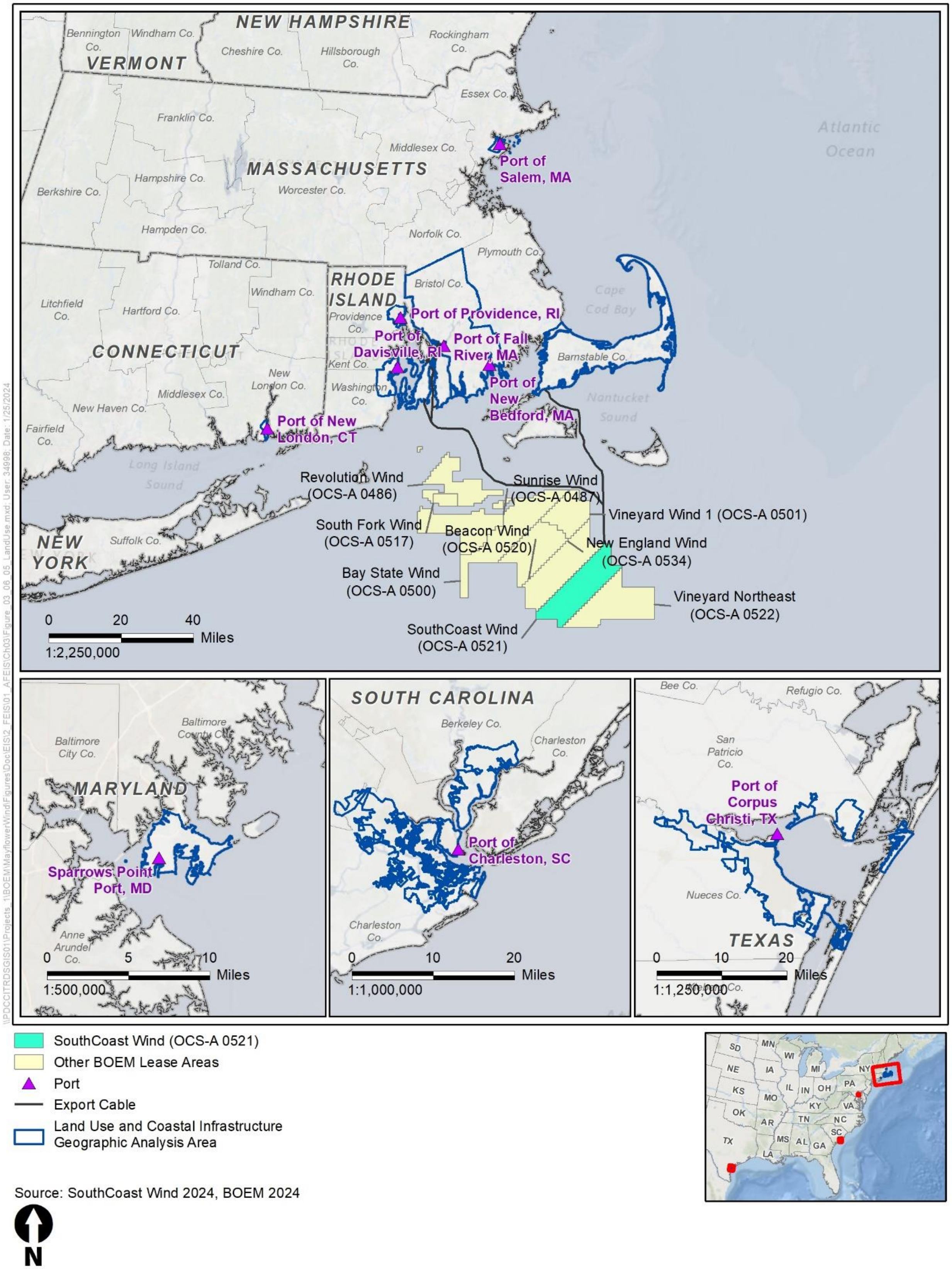


Figure 3.6.5-1. Land Use and Coastal Infrastructure geographic analysis area

Important landscape features near both Falmouth and Brayton Point include a combination of natural views such as beaches, shorelines, inlets, and scenic vistas, and human-made views such as historic districts, parks, and other cultural features. Portions of the Onshore Project area are part of the Cape Cod/Long Island EcoRegion, which features a unique variety of landscapes and habitat regions such as inlets, ocean bays and sounds, and historic districts (COP Appendix T, Section 6.2; SouthCoast Wind 2024).

The Project would use various ports for marshalling during construction, O&M, and decommissioning. The ports under consideration to support construction include New Bedford, Fall River, and Salem, Massachusetts; Davisville and Providence, Rhode Island; New London, Connecticut; Sparrows Point, Maryland; Charleston, South Carolina; Corpus Christi, Texas; as well as some international ports, including ports in Canada and Mexico. O&M vessel trips would originate primarily from the ports of New Bedford and Fall River, Massachusetts, and New London, Connecticut, with the potential for occasional repair and supply delivery trips originating from ports in Davisville and Providence, Rhode Island; Salem, Massachusetts; Sparrows Point, Maryland; and Charleston, South Carolina. The Ports of New Bedford and Fall River, Massachusetts would be the most likely ports for O&M activity. SouthCoast Wind expects the ports used for construction and O&M would also be used for decommissioning. The Port of New London is surrounded by land zoned as Open Space (OS), Maritime District (MD), Two Family Residential (R-2), and General Business (C-1) (City of New London 2020). The Port of New Bedford is surrounded by land zoned as Industrial A and Mixed-Use Business (City of New Bedford 2015). The Port of Salem is surrounded by land zoned as industrial (City of Salem 2012). The Port of Providence is surrounded by land zoned as waterfront and industrial (City of Providence 2021 The Davisville Port is located on land that is zoned as the Quonset Business Park District (North Kingstown 2024).The Port of Fall River is within land zoned as Waterfront and Transit-Oriented Development District (City of Fall River 2022). The Port of Corpus Christi is zoned as a General Commercial Zoning District (City of Corpus Christi GIS Services 2018). The Port of Sparrows Point is predominantly zoned for Commercial and Industrial uses (Baltimore County 2022). The Port of Charleston is surrounded by land zoned as Light Industrial (City of Charleston 2012).

3.6.5.2 Impact Level Definitions for Land Use and Coastal Infrastructure

Definitions of impact levels are provided in Table 3.6.5-1.

Table 3.6.5-1. Impact level definitions for land use and coastal infrastructure

Impact Level	Impact Type	Definition
Negligible	Adverse	Adverse impacts on area land use would not be detectable.
	Beneficial	Beneficial impacts on area land use would not be detectable.
Minor	Adverse	Adverse impacts would be detectable but would be short term and localized.
	Beneficial	Beneficial impacts would be detectable but would be short term and localized.

Impact Level	Impact Type	Definition
Moderate	Adverse	Adverse impacts would be detectable and broad based, affecting a variety of land uses, but would be short term and would not result in long-term change.
	Beneficial	Beneficial impacts would be detectable and broad based, affecting a variety of land uses, but would be short term and would not result in long-term change.
Major	Adverse	Adverse impacts would be detectable, long term, and extensive, and result in permanent land use change.
	Beneficial	Beneficial impacts would be detectable, long term, and extensive, and result in permanent land use change.

3.6.5.3 Impacts of the No Action Alternative on Land Use and Coastal Infrastructure

When analyzing the impacts of the No Action Alternative on land use and coastal infrastructure, BOEM considered the impacts of ongoing activities, including ongoing non-offshore wind and ongoing offshore wind activities on the baseline conditions for land use and coastal infrastructure. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities, as described in Appendix D, *Planned Activities Scenario*.

Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for land use and coastal infrastructure in the geographic analysis area as described in Section 3.6.5.1, *Description of the Affected Environment and Future Baseline Conditions*, would continue to be affected by ongoing non-offshore wind and offshore wind activities. Ongoing non-offshore wind activities that affect land use and coastal infrastructure include ongoing port maintenance and upgrades and onshore development. Ongoing offshore wind activities that may contribute to impacts on land use and coastal infrastructure include construction of the Vineyard Wind 1 (OCS-A 0501), South Fork projects (OCS-A 0517), and the Revolution Wind project (65 WTGs and two OSPs) in OCS-A 0486. The geographic analysis area lies within developed communities that would experience continued commerce and development activity in accordance with established land use patterns and regulations. Much of the geographic analysis area is highly developed, and most construction projects would likely affect land that has already been disturbed from past development, although some development on undeveloped land may also occur. Ports in the geographic analysis area would continue to serve marine traffic and industries and experience periodic dredging and improvement projects to meet ongoing needs.

Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative in combination with other planned non-offshore wind activities and planned offshore wind activities (without the Proposed Action).

Other planned non-offshore wind activities that would affect land use and coastal infrastructure in the geographic analysis area include dredging and port improvement projects, military use, onshore development, port expansion and offshore cable emplacement and maintenance (Appendix D, *Planned Activities Scenario*). Planned activities would contribute to impacts on land use and coastal infrastructure through the primary IPFs of accidental releases, light, port utilization, presence of structures, land disturbance, noise, traffic, and EMFs.

The following sections summarize the potential impacts of ongoing and planned offshore wind activities in the geographic analysis area during construction, O&M, and decommissioning of the projects. Ongoing and planned offshore wind projects in the geographic analysis area that would contribute to impacts on land use include those projects within all or portions of OCS-A-0486 (Revolution Wind), OCS-A-0487 (Sunrise Wind), OCS-A-0500 (Bay State Wind), OCS-A 0501 (Vineyard Wind 1), OCS-A 0517 (South Fork Wind), OCS-A-0520 (Beacon Wind), OCS-A 0522 (Vineyard Wind Northeast), and OCS-A 0534 (New England Wind) (Appendix D, Table D2-1). BOEM expects other offshore wind development activities to affect land use and coastal infrastructure through the following primary IPFs.

Accidental releases: Accidental releases of fuel/fluids/hazardous materials may increase because of offshore wind activities. Accidental release risks would be highest during construction, but still pose a risk during operation and decommissioning of offshore wind facilities. BOEM assumes all projects and activities would comply with laws and regulations to minimize releases. The overall impact of accidental releases on land use and coastal infrastructure is anticipated to be localized, short term, and negligible and could result in temporary restrictions on use of adjacent properties and coastal infrastructure during the cleanup process.

Light: As described in Section 3.6.9, *Scenic and Visual Resources,* aviation hazard lighting on offshore wind projects (encompassing 901 WTGs) could potentially be visible from beaches and coastal areas in and near the geographic analysis area. Visibility would depend on distance from shore, topography, atmospheric conditions, and whether ADLS technology is implemented, but would be long term. Nighttime lighting for construction and decommissioning of landfalls, onshore export cables, and interconnection cables could disrupt existing uses on adjacent properties. These impacts would be localized and short term. Nighttime lighting from operation of onshore substations, O&M facilities, and port facilities could disrupt existing or planned uses on adjacent properties in the long term, depending on the specific location of these facilities, the land use and zoning of adjacent properties, and the extent of visual screening incorporated into the design of planned offshore wind facilities. Given the existing level of development in the geographic analysis area and that facilities would be sited consistent with local zoning regulations, BOEM anticipates the impact of facility lighting on land use and coastal infrastructure would be minor.

Port utilization: Offshore wind energy projects would make productive use of port facilities for shipping, berthing, and staging throughout construction, operations, and decommissioning. Offshore wind would likely increase port utilization, and ports would experience beneficial impacts such as greater economic activity and increased employment due to demand for vessel maintenance services and related supplies, vessel berthing, loading and unloading, warehousing and fabrication facilities for offshore wind components, and other business activity related to offshore wind.

Offshore wind activity would support planned dredging and improvement projects at ports in the geographic analysis area. For example, the New Bedford Port Authority recently completed a $17 million expansion project to add 150,000 square feet of terminal space and has been award $24 million to reconstruct and extend Leonard's Wharf to support commercial fishing and the offshore wind industry (Port of New Bedford 2022; *Standard Times* 2022, 2023). The Connecticut Port Authority is redeveloping the Port of New London State Pier as a heavy-lift capable port facility that would support wind turbine construction staging and pre-assembly (Connecticut Port Authority 2021a, 2021b; *CT Examiner* 2022). The Sparrows Point Container Terminal project will construct a new container terminal and intermodal yard located on 330 acres within the Tradepoint Atlantic industrial development site on Sparrows Point. If multiple offshore wind energy projects rely on the same ports, this simultaneous use could stress port resources and could increase the marine and road traffic, noise, and air pollution in the area. Overall, other offshore wind projects would have constant, long-term, minor beneficial impacts on port utilization due to the productive use of ports designated for offshore wind activity, as well as localized, short-term, minor adverse impacts in cases where individual ports are stressed due to simultaneous project activity.

Presence of structures: As described in Section 3.6.9, *Scenic and Visual Resources*, 901 WTGs associated with offshore wind projects other than the Proposed Action could be visible from some shorelines (depending on vegetation, topography, and atmospheric conditions). Visibility would vary with distance from shore, topography, and atmospheric conditions, and impacts would generally be localized, constant, and long term. The presence of WTGs would have negligible impacts on land use because, while WTGs could be visible from some shoreline locations in the geographic analysis area, the WTGs would be at such a distance that effects would be limited. Moreover, land use patterns are well-established in areas from which WTGs would be visible; it is not reasonably foreseeable that these well-established patterns would change as a result of far offshore WTG installation and operation.

The presence of onshore transmission cable infrastructure is anticipated to have minimal long-term impacts on land use. BOEM anticipates that new substations for offshore wind projects would be within or near existing substations, or in locations designated for such uses. Consistent with the Proposed Action, BOEM also assumes that cable conduits would primarily be underground and co-located with roads or other utilities (COP Volume 1, Section 3.3.7; SouthCoast Wind 2024). As a result, operation of substations and cable conduits would not affect the established and planned land uses for a local area and would have negligible impacts on land use.

Land disturbance: Offshore wind installation would require installation of onshore transmission cable infrastructure and substations, which would cause temporary traffic delays and could temporarily affect access to adjacent properties. These impacts would only last through construction and occasionally during maintenance events. The exact extent of impacts would depend on the locations of landfall and onshore transmission cable routes for offshore wind energy projects; however, other offshore wind projects would generally have localized, negligible, and short-term impacts during construction or maintenance and no long-term impacts on land use.

Noise: Offshore wind projects would generate noise, primarily associated with onshore cable trenching and substation construction and operation. Noise from offshore wind construction activities is not expected to reach the geographic analysis area. This IPF may affect land use if noise levels influence business activity or residents' and visitors' decisions on where to visit or live. Noise from onshore construction and substation operations is anticipated to be similar to noise from other ongoing construction projects and substation operation in the geographic analysis area and therefore would have a minor, short- to long-term impact on land use.

Traffic: Offshore wind projects could result in increased road traffic and congestion that may affect land use and coastal infrastructure because traffic volumes may dictate where residents and businesses choose to locate. Onshore construction of cables for offshore wind projects will likely disrupt road traffic for a short period. Occasional, temporary traffic delays would result from repairs and maintenance. The exact extent of impacts would depend on the locations of landfall and onshore transmission cable routes for offshore wind energy projects and traffic management plans developed with local governments. Traffic impacts on land use and coastal infrastructure are anticipated to be minor.

EMFs: Onshore export cables in the geographic analysis area would generate EMFs during operation of wind farms. Residents and visitors may be exposed to EMFs where cables are installed near businesses, residences, or in public areas. Common household items including television sets, hair dryers, and electric drills can emit magnetic fields similar to or higher in intensity than those emitted by power cables (CSA Ocean Sciences, Inc. and Exponent 2019). Assuming other offshore wind export cables produce similar EMF levels as the Proposed Action, at a burial depth of 3 feet (1 meter), maximum emissions directly above the onshore export cables would be 403 milliGauss, based on a cable operating voltage of 275-kV (COP Appendix P1; SouthCoast Wind 2024). This value is well below the reported human health reference levels of 2,000 milliGauss for the general population (International Commission on Non-ionizing Radiation Protection 2010). Even if other offshore wind export cables were of higher voltage or buried closer to the surface, EMF levels are still anticipated to be well below the human health reference levels; therefore, EMF impacts on land use would be long term but negligible.

Conclusions

Impacts of the No Action Alternative: Under the No Action Alternative, land use and coastal infrastructure would continue to be affected by existing environmental trends and ongoing activities. BOEM expects ongoing activities to have continuing temporary and permanent impacts on land use and coastal infrastructure, primarily through the IPFs of accidental releases, light, port utilization, presence of structures, land disturbance, noise, traffic, and EMFs. BOEM anticipates that the impacts of ongoing activities would have both **minor beneficial** and **minor** adverse impacts in the geographic analysis area.

Cumulative Impacts of the No Action Alternative: Under the No Action Alternative, existing environmental trends and ongoing activities would continue to be affected by the primary IPFs of accidental releases, light, port utilization, presence of structures, land disturbance, noise, traffic, and EMFs. Planned non-offshore wind activities, primarily increased port maintenance and expansion and construction activity, would have impacts similar to those of ongoing activities. Planned offshore wind activities would contribute to effects on land use through land disturbance (during installation of onshore cable and substations) and accidental releases during onshore construction, as well as through the presence of offshore lighting on wind energy structures and views of the structures themselves that could affect the use and value of onshore properties. Beneficial impacts on land use and coastal infrastructure would result because the development of offshore wind would support the productive use of ports and related infrastructure designed or appropriate for offshore wind activity (including construction and installation, O&M, and decommissioning). BOEM anticipates that the cumulative impact of the No Action Alternative would be **minor** adverse and **minor beneficial**.

3.6.5.4 Relevant Design Parameters and Potential Variances in Impacts

This EIS analyzes the maximum-case scenario; any potential variances in the proposed Project build-out as defined in the PDE would result in impacts similar to or less than those described in the sections below. The following proposed PDE parameters (Appendix C, *Project Design Envelope and Maximum-Case Scenario*) would influence the magnitude of the impacts on land use and coastal infrastructure.

- Export cable route locations and onshore substation site variants within the Onshore Project area.
- The time of year during which construction occurs. Tourism and recreational activities in the geographic analysis area tend to be higher from May through September, and especially from June through August (Parsons and Firestone 2018). If Project construction were to occur during this season, impacts on roads and land uses during the busy tourist season would be exacerbated.

SouthCoast Wind has committed to measures to minimize impacts on land use and coastal infrastructure by developing crossing and proximity agreements with utility owners prior to utility crossings and developing a construction schedule to minimize effects to tourism related activities, including scheduling construction outside of major events and avoiding construction during the summer tourist season (COP Volume 2, Section 14.2.2.1.2 and Table 16-1; SouthCoast Wind 2024).

3.6.5.5 Impacts of Alternative B – Proposed Action on Land Use and Coastal Infrastructure

The Proposed Action would likely result in localized impacts that would not alter the overall character of land use and coastal infrastructure in the geographic analysis area. The most impactful IPFs would likely be land disturbance during cable installation, the visual impact of offshore WTGs, and the utilization of ports.[2] Other IPFs would likely contribute impacts of lesser intensity and extent and would occur primarily during construction but may also occur during operations and decommissioning.

Accidental releases: Accidental releases from the Proposed Action could include release of fuel/fluids/hazardous materials as a result of port usage, installation of the onshore cables and substation/converter stations, and substation/converter stations operation (COP Volume 2, Section 12.2.5; SouthCoast Wind 2024). Potential contamination may occur from unforeseen spills or accidents, and any such occurrence would be reported and addressed in accordance with the local authority. The

[2] The Proposed Action would not directly require any upgrades to port infrastructure but would make productive use of existing ports.

impact of accidental releases on land use and coastal infrastructure could result in temporary restriction on use of adjacent properties and coastal infrastructure during the cleanup process. Accordingly, accidental releases from the Proposed Action alone would have localized, short-term, negligible to minor impacts on land use.

Light: The Proposed Action would include the installation and continuous use of aviation hazard avoidance lighting on WTGs and OSPs during low-light and nighttime conditions. During operations, lighting from all the Proposed Action's 147 WTGs could potentially be visible from certain coastal or elevated locations in the geographic analysis area. SouthCoast Wind proposes to implement an ADLS to automatically turn the aviation obstruction lights on and off in response to the presence of aircraft in proximity of the wind farm. Such a system may reduce the amount of time that the lights are on, thereby potentially minimizing the visibility of the WTGs from shore and related effects on land use (COP Volume 1, Section 3.3.12; SouthCoast Wind 2024). During construction, lighting technology would be used to minimize impacts on avian and bat species, which would also help reduce impacts on land use (COP Volume 2, Table 16-1; SouthCoast Wind 2024). At onshore facilities, security lighting installed along onshore substation and converter station perimeter fencing and at building entrances would be down shielded to mitigate light pollution and would be designed to comply with night-sky lighting standards (COP Volume 2, Section 8.2.2.2; SouthCoast Wind 2024). SouthCoast Wind has also committed to working with Falmouth and Somerset, Massachusetts to ensure the lighting scheme for the onshore substation and converter stations complies with town requirements. As a result, onshore substation and converter station lighting would have a long-term, continuous, negligible impact on land use in the geographic analysis area, due to potential effects on property use and value.

Port utilization: The Proposed Action includes no port expansion activities but would use ports that have expanded or would expand to support the wind energy industry generally. For instance, the New Bedford Marine Commerce Terminal, which would be one of the primary ports used by SouthCoast Wind during O&M, has been expanded specifically to support the construction of offshore wind facilities (COP Volume 2, Section 12.1.5; SouthCoast Wind 2024). In addition, SouthCoast Wind has made financial commitments for port upgrades that are intended to enhance the capabilities of the existing port facility in Fall River, Massachusetts.

Land uses and coastal infrastructure affected by construction of offshore components would include temporary construction ports including New Bedford, Fall River, and Salem, Massachusetts; Davisville and Providence, Rhode Island; and New London, Connecticut; a small number of vessel trips may also originate from the ports of Sparrows Point, Maryland; Charleston, South Carolina; and Corpus Christi, Texas. SouthCoast O&M vessel trips would originate primarily from the ports of New Bedford and Fall River, Massachusetts and New London, Connecticut, with the potential for occasional repair and supply delivery trips originating from ports in Davisville and Providence, Rhode Island; Salem, Massachusetts; Sparrows Point, Maryland; and Charleston, South Carolina. These ports are expected to be used during construction and O&M but have independent utility and would not be dedicated to the Project. Proposed uses at existing port facilities would be consistent with the current land uses occurring at these locations and are not expected to result in changes to land use or zoning. The increased activity at these ports would provide a source of investment in the coastal infrastructure.

Activities associated with Proposed Action construction would generate noise, vibration, and vehicular traffic at port locations. These impacts are typical for industrial ports and would not hinder other nearby land uses or use of coastal infrastructure. Overall, the construction and installation of offshore components, O&M, and decommissioning for the Proposed Action alone would have negligible adverse and minor beneficial impacts on land use and coastal infrastructure by supporting designated uses and infrastructure improvements at ports.

Presence of structures: The WTGs could be visible from certain coastal and elevated mainland areas (depending on vegetation, topography, and atmospheric conditions), which could have long-term impacts on land use if the views influence visitor decisions on locations or properties to visit or purchase. The WTGs would be installed over 20 nm (32.2 kilometers) from the closest point to the Massachusetts shore. As detailed in Section 3.6.9, *Scenic and Visual Resources*, the WTGs would not dominate offshore views as a result of their proposed distance from shore, even under ideal weather and atmospheric conditions for viewing. The Proposed Action alone would have a long-term, continuous, minor impact on land use and coastal infrastructure in the geographic analysis area due to views of WTGs and the potential effects on property use and value.

In general, impacts on land use and zoning from onshore construction and operations would be minimized as the Project would use existing roads, ROWs, and industrial areas to the extent practicable. The three proposed Falmouth landfalls are in locations zoned as Public Use by the Town of Falmouth, including Worcester Park, Central Park, and the Surf Drive Beach public parking area. The Public Use zoning designation does not allow the installation of electrical transmission infrastructure; any landfall option would likely require obtaining an easement from the Town of Falmouth and a zoning exemption from the state of Massachusetts (COP Volume 2, Section 12.2.1.1; SouthCoast Wind 2024). Because the overall size of the area affected would be small (less than 1 acre for the transition joint bays) and the permanent electrical infrastructure would be buried, the long-term use of the public sites (i.e., parks and parking area) would not be adversely affected. From the landfall locations, the Falmouth onshore cable route would travel north below the surface of existing roadways/public rights-of-way to the onshore substation, and would be in proximity to primarily residential, commercial, and Public Use-zoned land. Impacts on land use and zoning would be minimized because the onshore cables would use existing roads and ROWs to the extent practicable.

If Falmouth is selected as the POI for Project 2, SouthCoast Wind would construct the Falmouth substation at one of two privately owned sites: Lawrence Lynch or Cape Cod Aggregates. The site of the preferred Lawrence Lynch substation is 27.3 acres (11.01 hectares) zoned as Light Industrial A and is a former quarry that is currently used as an asphalt plant. The site of the Cape Cod Aggregates substation is 33.6 acres (13.6 hectares) located on parcels zoned as Agricultural AA in a Water Resource Overlay District that is presently used as a sand and gravel quarry. Similar to the landfall locations, zoning relief would likely be required from the Town of Falmouth zoning bylaws for the two substation sites. As both substation sites are located on current and former quarries and are on or nearby industrially zoned areas, it is not anticipated that the substations would conflict with existing or future land uses.

On November 17, 2021, SouthCoast Wind filed a zoning petition (D.P.U 21-142) with the Massachusetts Department of Public Utilities seeking comprehensive exemption from the operation of the zoning bylaws of the Town of Falmouth, including "exemptions from the use provisions of the Falmouth Zoning Bylaw, as well as certain provisions regarding dimensional requirements, signage, height, site plan review, parking, nuisances, noise, and interference, and other local permitting provisions." The Massachusetts Department of Public Utilities may grant a zoning exemption only if it determines the proposed use of the land is "reasonably necessary for the public interest or convenience" (Massachusetts General Laws Chapter 40A§3). Due to the need for broad-scale zoning relief, impacts on land use would be moderate. However, because the proposed uses must be in the public interest for zoning relief to be granted, the onshore facilities would use existing ROWs to the extent practicable, and because the Project would not require a change to an underlying zoning designation, impacts would be minimized and there would be no long-term changes to surrounding land uses.

For Brayton Point, the intermediate landfall locations and cable routes on Aquidneck Island would be located within road or utility ROWs or privately owned land, and no impacts on local zoning laws are anticipated (COP Volume 2, Section 12.2.1.1; SouthCoast Wind 2024). Because all Project components in Somerset (converter stations, landfalls, cable routes, transmission line) are sited within Industrial District zoning, and development of converter stations and associated equipment is consistent with this use, no long-term effects on land use or zoning are anticipated.

Onshore construction is expected to result in temporary or permanent impacts on local residents, businesses, and the community along the proposed onshore export cable routes during the construction and decommissioning period. Landfall construction methods would minimize land use impacts, and areas would be restored to their previous condition after construction (COP Volume 2, Section 12.2.2.1; SouthCoast Wind 2024). Temporarily increased noise levels, lighting, and traffic during construction may affect local sensitive receptors (e.g., schools, medical facilities), but would be minimized through best management practices and would not change existing land uses. SouthCoast Wind has committed to implementing a construction schedule that would minimize effects to tourism related activities, such as scheduling construction activities to avoid the height of the summer tourist season and coordinating with stakeholders/visitors' bureaus to schedule outside of major events, to the extent feasible (COP Volume 2, Section 12.2.2.1; SouthCoast Wind 2024).

Land disturbance: The Proposed Action's onshore export cable infrastructure would be installed underground in a duct bank, generally along, under, or adjacent to existing roads or utility ROW. HDD would be used to minimize impacts on land disturbance at the Falmouth and Brayton Point landfalls and at the intermediate landfall entering and exiting Aquidneck Island. Installation of the cable landfall sites and underground cable routes would temporarily disturb neighboring land uses through construction noise, vibration, dust, and travel delays along the affected roads. These impacts are anticipated to last for the duration of construction; following construction, the cable route corridors would be returned to their previous condition and use. Cables would be installed in trenches with a maximum disturbance width of 35 feet (11 meters). The Falmouth onshore export cables and transmission line could require up to 23.3 acres (9.4 hectares) of disturbance, and the Brayton Point onshore export cables and transmission line could require up to 6.1 acres (2.5 hectares) of disturbance. O&M would not result in land disturbance except in the event that cable maintenance or replacement is required. During decommissioning, the onshore cables may be left in place for possible future reuse or removed, with impacts similar to those from construction. Land use impacts would be minimized by using existing ROWs, co-locating project components and restoring areas to pre-disturbed conditions following construction, resulting in minor land use impacts.

The construction of the onshore substation and the onshore converter stations would result in temporary and permanent impacts due to construction and the use of temporary construction workspace. Construction of these facilities would require a permanent site, including area for equipment and buildings, equipment yards, energy storage, stormwater management, and landscaping. The maximum temporary and permanent disturbance footprint for the Falmouth substation would be 26 acres (10.5 hectares), and the maximum temporary and permanent disturbance footprint for each of the up to two Brayton Point converter stations would be 10 acres (4 hectares). The facilities are not anticipated to conflict with surrounding land uses, as described under the *Presence of structures* IPF.

Noise: The Proposed Action would comply with local regulatory authority requirements to minimize impacts on nearby communities (COP Volume 2, Section 12.2.3.1; SouthCoast Wind 2024). Typical construction equipment ranges from a generator or refrigerator unit at 73 dBA at 50 feet (15 meters) to an impact pile driver at 101 dBA at 50 feet (15 meters). As the WTGs and OSPs associated with the Proposed Action would be built 20 nm (48 kilometers) offshore, noise effects from offshore construction and decommissioning would be temporary and negligible. Onshore, temporarily increased noise levels during construction may affect local sensitive receptors (such as religious locations, recreational areas, schools, and other places that are particularly sensitive to construction) but would be minimized through best management practices. Because there are no relevant regulatory limits for construction noise, the Proposed Action would follow a guideline limit of 65 dBA during the daytime. The greatest impacts would be from HDD activity at the landfall sites in Falmouth, which would require applicant-proposed mitigation measures, such as temporary construction noise barriers and equipment silencers, to achieve the 65 dBA guideline at the closest sensitive receptors (COP Volume 2, Sections 9.1.3.2.2 and 9.1.5; SouthCoast Wind 2024). With implementation of these applicant-proposed mitigation measures (refer to Table G-1 in Appendix G, *Mitigation and Monitoring*), impacts from construction noise would be short-term and minor and are not anticipated to change existing land uses.

During operations of the Proposed Action, the converter stations and substation sites would generate increased noise levels in the immediate vicinity of these sites. Based on noise modeling conducted at the two Falmouth substation sites, mitigation may be required at both sites in order to meet the MassDEP limit of 10 dBA above the measured minimum background sound levels at the closest noise-sensitive locations (COP Volume 2, Section 9.1.4.1; SouthCoast Wind 2024). The greatest potential for impacts would be at the Lawrence Lynch substation site, which is located near low-density residential housing. Applicant-proposed mitigation measures include installing noise barriers to reduce sound levels to comply with Massachusetts regulatory requirements. For Brayton Point, noise generated by converter station operation would need to be below 83 dBA to achieve compliance with local and state noise ordinances. The results of the acoustic modeling assessment indicate that the audible noise produced by an HVDC converter station is expected to be 60 dBA and would meet Town of Somerset and MassDEP standards (POWER Engineers 2023). It is anticipated a second converter station at Brayton Point would produce similar results. Because the proposed onshore substation sites and converter stations would be located on gravel quarries and a former power plant and would meet state and local noise ordinances with or without applicant-proposed measures to reduce noise levels (Appendix G, Table G-1), there would be no changes in land use. Impacts would be long-term but minor.

Traffic: Cable installation within roadways would result in temporary traffic impacts due to construction-period lane closures and potential detours. The onshore cable route for Falmouth is expected to cover up to 6.4 miles (10.2 kilometers), 0.7 mile (1 kilometer) for Brayton Point, and 3 miles (4.8 kilometers) on Aquidneck Island. Best management practices and maintenance of traffic plans would be coordinated with stakeholders, Falmouth and Somerset, Massachusetts, and Portsmouth, Rhode Island, and would adhere to a construction schedule that avoids the height of summer tourism seasons (COP Volume 2, Section 12.2.2.1). Construction staging in parking lots adjacent to or near the landfall locations at Falmouth and Aquidneck Island may temporarily reduce available parking; however, impacts would be limited because construction would be outside of the peak tourism seasons. Traffic impacts would be limited to the immediate construction area and would be minor and short-term. Roadways would be returned to preconstruction conditions, and changes to existing land use would not be expected.

EMFs: Once installed, onshore export cables would generate EMFs during operations of the Project. The cables would be installed largely in public road ROWs where visitors may be exposed to EMFs generated by the cables. Buried power cables produce weak field strengths well below the recommended threshold values for human exposure (CSA Ocean Sciences, Inc. and Exponent 2019). Based on EMF modeling of 275-kV HVAC export cables buried at a depth of 3 feet (0.9 meter), maximum emissions directly above the onshore export cables would be 403 milliGauss (COP Appendix P1; SouthCoast Wind 2024). From 10 to 25 feet (3–8 meters) from the cable centerline, emissions values drop to between 32 and 157 milliGauss. These values are well below the reported human health reference levels of 2,000 milliGauss for the general population (International Commission on Non-ionizing Radiation Protection 2010). The Project may also use HVDC cables, and while SouthCoast Wind did not conduct modeling for HVDC cables, typical EMF levels in the immediate vicinity of HVDC cables (less than 1,000 milliGauss) are not known to cause health risks (COP Appendix P2; SouthCoast Wind 2024). EMFs from onshore cable routes is not anticipated to adversely affect human health nor require a change in land use to reduce exposure to human populations. Therefore, impacts on land use would be long term but negligible.

3.6.5.6 Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned non-offshore wind activities and other ongoing and planned offshore wind activities. Ongoing and planned non-offshore wind activities that affect land use and coastal infrastructure in the geographic analysis area include ongoing dredging and port maintenance, military use, and offshore cable emplacement and maintenance.

The incremental impacts contributed by the Proposed Action to the accidental release impacts on land use and coastal infrastructure from ongoing and planned activities including offshore wind would increase the risk of (and thus the potential impacts from) accidental releases of fuel/fluids/hazardous materials in the geographic analysis area. The visual impacts associated with lighting and presence of structures of 1,048 WTGs from the Proposed Action and other offshore wind projects, portions of which would be visible from coastlines and elevated inland locations, could have long-term impacts on land use if the views and nighttime lighting influence visitor decisions on locations or properties to visit or purchase. Due to the distances of the WTGs from shore, impacts would be similar to the Proposed Action alone. Cumulative impacts would be long term and negligible from lighting and long term and minor from lighting and presence of structures.

Cumulative impacts related to port utilization would be minor if increased activity levels stress port resources. Minor beneficial impacts would also result due to increased port utilization and resulting economic activity.

Impacts on land use and coastal infrastructure would be additive only if land disturbance associated with one or more other projects occurs in close spatial and temporal proximity. Assuming that new substations for offshore wind projects would be in locations designated for industrial or utility uses, and underground cable conduits would primarily be co-located with roads or other utilities, operation of substations and cable conduits would not affect the established and planned land uses for a local area. Therefore, cumulative impacts would be minor and short term due to the potential for construction-related disturbance and access limitations along the export cable routes.

Ongoing and planned offshore wind activities would generate comparable types of impacts to those of the Proposed Action from noise, traffic, and EMF impacts. Other projects would be required to comply with the same or similar noise regulations as the Proposed Action, which would minimize potential noise impacts. Cumulative impacts on traffic would only occur if construction associated with other projects generates traffic in close spatial and temporal proximity as the Proposed Action. Other offshore wind projects are anticipated to result in similar, insignificant EMF levels as the Proposed Action. BOEM expects the cumulative impacts of noise, traffic, and EMFs on land use and coastal infrastructure to be localized and minor.

Conclusions

Impacts of the Proposed Action: BOEM anticipates that impacts on land use and coastal infrastructure from the Proposed Action alone would range from negligible to moderate with minor beneficial impacts. The Proposed Action would have negligible impacts resulting from port utilization, minor impacts resulting from land disturbance during onshore installation of the cable route and substation, negligible to minor impacts resulting from accidental spills, and localized minor impacts from noise and traffic. There would be moderate impacts associated with the Falmouth landfall sites and substations, which would require zoning relief from the Town of Falmouth zoning bylaws. Overall, BOEM anticipates there would be **moderate adverse** impacts with **minor beneficial** impacts on land use and coastal infrastructure.

Cumulative Impacts of the Proposed Action: BOEM anticipates that the cumulative impacts associated with the Proposed Action when combined with the impacts from ongoing and planned activities including offshore wind would result in **moderate adverse** impacts and **minor beneficial** impacts on land use and coastal infrastructure in the geographic analysis area.

3.6.5.7 Impacts of Alternative C on Land Use and Coastal Infrastructure

Impacts of Alternative C: The impacts of Alternative C on land use and coastal infrastructure would be similar to those of the Proposed Action except for land disturbance, traffic, and noise associated with the onshore export cable corridor route. Under both Alternatives C-1 and C-2, the export cable route to Brayton Point would be rerouted onshore to avoid sensitive fish habitat in the Sakonnet River. The onshore export cables would be installed in trenches within the existing roadways where feasible, but may require pathways on road shoulders, medians, and private property.

Land disturbance: Alternatives C-1 and C-2 would increase the total length of the Brayton Point onshore cable route by approximately 9 miles and 13 miles (14 and 21 kilometers), respectively. Similar to the Proposed Action, temporary impacts on land disturbance would occur largely within the existing roadways or along the immediate edge of the road ROW. The roadbed would be restored immediately following construction. There is some potential for the onshore export cables to require pathways on private property, transmission ROWs, and railroad ROWs, which may require SouthCoast Wind to obtain easements. Impacts would be most pronounced along the southern portions of both alternatives where the roads are 20 feet (6.1 meters) wide with no shoulder and lined with historic stonewalls, hedges, old growth trees and historic structures, which may be disturbed during construction. The Alternative C-1 landfall location would be sited in the parking lot of Second Beach in an Open Space zoning district in Middletown (Town of Middletown 2022). The Alternative C-2 landfall locations would be in the parking lot of the Sakonnet Point Marina in Little Compton and on a private parcel zoned as Waterfront off Schooner Drive in Tiverton (Town of Little Compton 2022; Town of Tiverton 2022). While local zoning laws generally allow for electrical infrastructure in these areas, further coordination would be required with affected municipalities to facilitate authorization of the land use. Impacts on surrounding land uses are anticipated to be moderate because Alternative C would affect a larger area than the Proposed Action, but impacts would be short-term and underground installation of utility infrastructure in public ROWs would not result in long-term land use changes.

Traffic: Due to the increase in the total length of the onshore export cable corridor route under Alternative C, construction associated with the cable installation within or adjacent to the roadway would result in an increase in temporary traffic impacts such as lane closures, shifted traffic patterns, or closed roadways and parking areas compared to the Proposed Action. Because the onshore cable routes would be longer than under the Proposed Action, the amount of roadway and the duration of impacts from construction would be longer, with Alternative C-2 having the greater impact. From the landfall, the Alternative C-1 onshore route would head north from Middletown, Rhode Island along one of two variations and then follow Route 138 through mostly rural residential and agricultural land into the town of Portsmouth, before following the same route as the Proposed Action into Mount Hope Bay. The Alternative C-1 onshore route includes emergency facilities, which may result in potential temporary access limitations to these facilities during construction. Alternative C-2 would follow mostly Routes 77 and 177 through Little Compton and Tiverton along rural residential communities and agricultural land.

The southern portions of the roadways that would be used for both alternatives are narrow two-lane roads with no shoulder, and construction would cause the greatest traffic delays in these areas. Road closures during construction of the onshore export cable route would temporarily restrict access to certain portions of the surrounding areas. Roadways would be returned to pre-construction conditions and permanent changes to traffic and traffic patterns would not occur.

Noise: Alternative C would involve more onshore construction activities and related noise impacts as a result of the increased length of the onshore export cable route. Impacts from noise under Alternative C would be minimized through the use of existing ROWs and complying with best management practices to minimize noise impacts during construction (COP Volume 2, Table 16-1; SouthCoast Wind 2024). While the increased export cable route would likely result in extended construction with potentially increased impacts on surrounding land uses from noise, the overall impacts of construction under Alternative C would be of the same magnitude as those of the Proposed Action.

Cumulative Impacts of Alternative C: In the context of reasonably foreseeable environmental trends, cumulative impacts of Alternative C would be similar to those described under the Proposed Action.

Conclusions

Impacts of Alternative C: Alternative C would increase the length of onshore cable route, resulting in increased impacts on temporary and permanent land disturbance compared to the Proposed Action, with Alternative C-2 resulting in the most impacts. The overall impact magnitudes would be the same as the Proposed Action because the cable corridors are anticipated to be largely installed in existing roadways, and the primary impacts would be limited to the duration of construction. Overall, impacts on land use and coastal infrastructure would be **moderate adverse** and **minor beneficial** impacts.

Cumulative Impacts of Alternative C: In context of reasonably foreseeable environmental trends, cumulative impacts of Alternative C on land use and coastal infrastructure would be similar to those of the Proposed Action: **moderate adverse** and **minor beneficial** on land use and coastal infrastructure.

3.6.5.8 Impacts of Alternatives D (Preferred Alternative), E, and F on Land Use and Coastal Infrastructure

Impacts of Alternatives D, E, and F: The impacts of Alternatives D, E, and F on land use and coastal infrastructure would be similar to those of the Proposed Action because these alternatives differ only with respect to offshore components, which would have minimal effects on land use. The impacts on land use resulting from land disturbance and maintenance associated with onshore construction under Alternatives D, E, and F are expected to be the same as those of the Proposed Action.

Cumulative Impacts of Alternatives D, E, and F: In context of reasonably foreseeable environmental trends, the cumulative impacts of Alternatives D, E, and F would be the same as described under the Proposed Action.

Conclusions

Impacts of Alternatives D, E, and F: The impacts associated with the Proposed Action alone would not change under Alternatives D, E, and F because the alternatives only differ in offshore components, and offshore components would not substantially contribute to impacts on land use and coastal infrastructure; the same construction and installation, O&M, and conceptual decommissioning activities would still occur. Overall, impacts on land use and coastal infrastructure would be **moderate adverse** with **minor beneficial** impacts.

Cumulative Impacts of Alternatives D, E, and F: In context of reasonably foreseeable environmental trends, the cumulative impacts of Alternatives D, E, and F would be the same as the Proposed Action: **moderate adverse** and **minor beneficial**.

3.6.5.1 Comparison of Alternatives

The moderate adverse impacts with minor beneficial impacts on land use under the Proposed Action would be the same for Alternatives D, E, and F because these alternatives would differ only with respect to offshore components, and offshore components would not substantially contribute to impacts on land use and coastal infrastructure.

Alternatives C-1 and C-2 would increase the length of the Brayton Point onshore cable route, resulting in increased impacts from land disturbance, traffic, and noise compared to the Proposed Action and other action alternatives. Because of the longer length of the cable route, Alternative C-2 is anticipated to result in the greatest impacts on land use of any of the alternatives. However, because impacts from onshore construction would be short-term and would not result in long-term changes to traffic patterns or land use, the overall impact magnitude would remain moderate and minor beneficial.

3.6.5.2 Proposed Mitigation Measures

No measures to mitigate impacts on land use and coastal infrastructure have been proposed for analysis.

3.6 Socioeconomic Conditions and Cultural Resources

3.6.6 Navigation and Vessel Traffic

This section discusses navigation and vessel traffic characteristics and potential impacts on waterways and water approaches from the proposed Project, alternatives, and ongoing and planned activities in the navigation and vessel traffic geographic analysis area. The navigation and vessel traffic geographic analysis area, as shown on Figure 3.6.6-1 includes coastal and marine waters within a 10-mile (16.1-kilometer) buffer of the Offshore Project area and adjacent lease areas off Massachusetts and Rhode Island, as well as waterways leading to ports that may be used by the Project. Information presented in this section draws primarily upon the NSRA[1] (COP Appendix X; SouthCoast Wind 2024), which was conducted per the guidance in USCG *Navigation and Vessel Inspection Circular 01-19* (USCG 2019).

3.6.6.1 Description of the Affected Environment

Regional Setting

Proposed Project facilities would be approximately 26 nm (48 kilometers) south of Martha's Vineyard and 20 nm (37 kilometers) south of Nantucket, Massachusetts under a Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf (OCS-A 0521). Figure 3.6.6-2 shows vessel traffic in the vicinity of the Lease Area based on Automatic Identification System (AIS) data and nearby routing measures (traffic separation zones, precautionary areas). There are several routing measures[2] that assist with routing vessel traffic to help avoid navigation hazards in the vicinity of the Lease Area. Two Traffic Separation Systems[3] influence deep-draft vessel routes in the geographic analysis area: the Nantucket/Ambrose Shipping Safety Fairway (referred to hereafter as Nantucket Ambrose Fairway) and the Narragansett Bay Traffic Separation System in Rhode Island Sound (Figure 3.6.6-2).

---

[1] The "Study Area" used in the NSRA (COP Volume 2, Figure 13-1; SouthCoast Wind 2024) is inclusive of the Project area and offshore waters extending at least 20 nm (37 kilometers) on all sides of the Project area and offshore ECCs. The navigation and vessel traffic geographic analysis area is generally consistent with the NSRA Study Area but also includes more distant ports that may be used by the Project. Where this EIS references risk analysis from the NSRA, it is specific to the geographic scope of the NSRA Study Area.

[2] The term *routing* measure originates from the International Maritime Organization. USCG submits and obtains approval for routing measures within U.S. navigable waters to the International Maritime Organization. Areas to Be Avoided, Inshore Traffic Zones, No Anchoring Areas, Precautionary Areas, Roundabouts, and Traffic Separation Schemes are all routing measures (USCG 2020: Appendix B).

[3] A Traffic Separation System, is an internationally recognized measure that minimizes the risk of collision by separating vessels into opposing streams of traffic through establishment of traffic lanes. Vessel use of Traffic Separation System is voluntary.

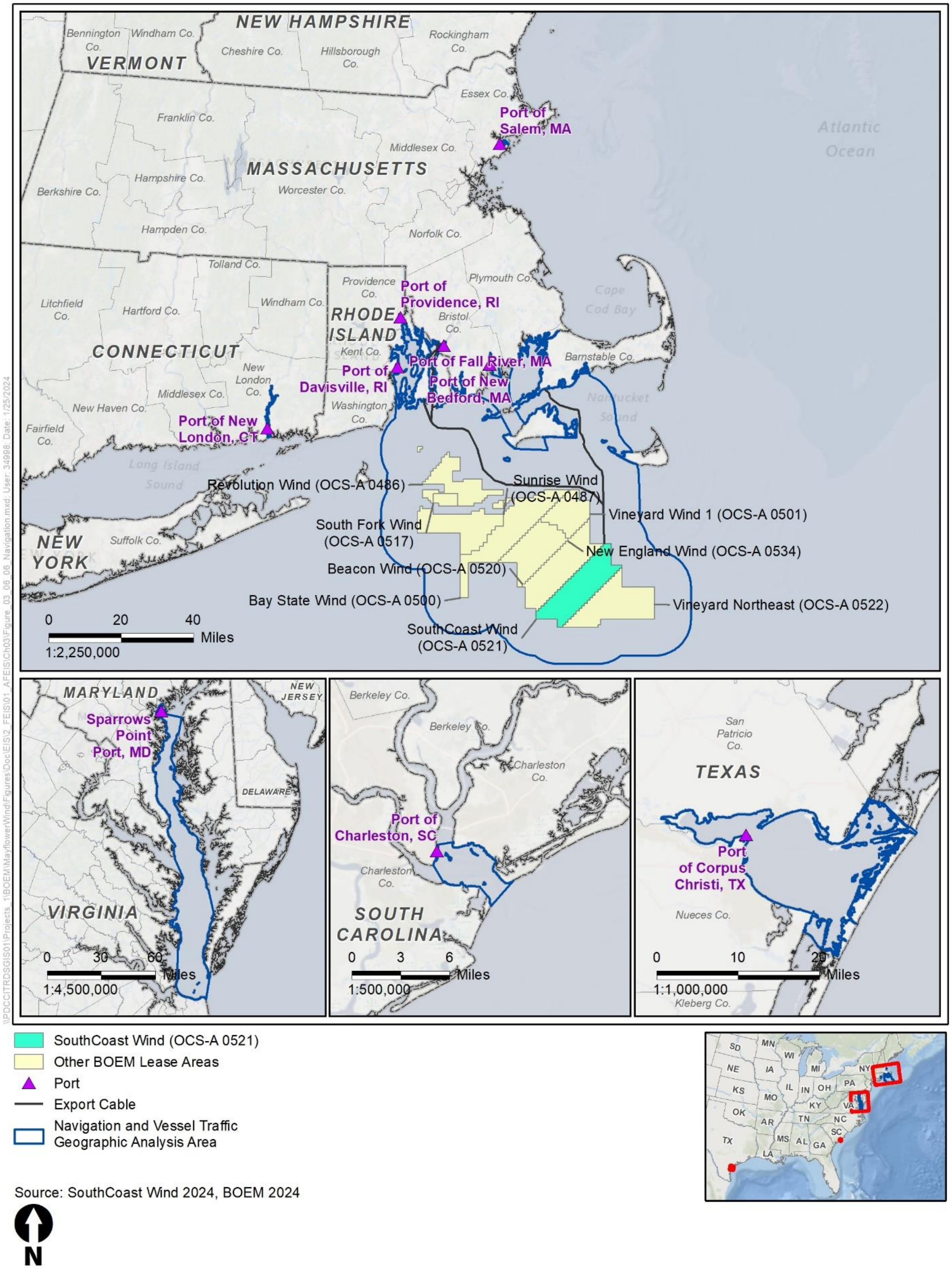


Figure 3.6.6-1. Navigation and vessel traffic geographic analysis area

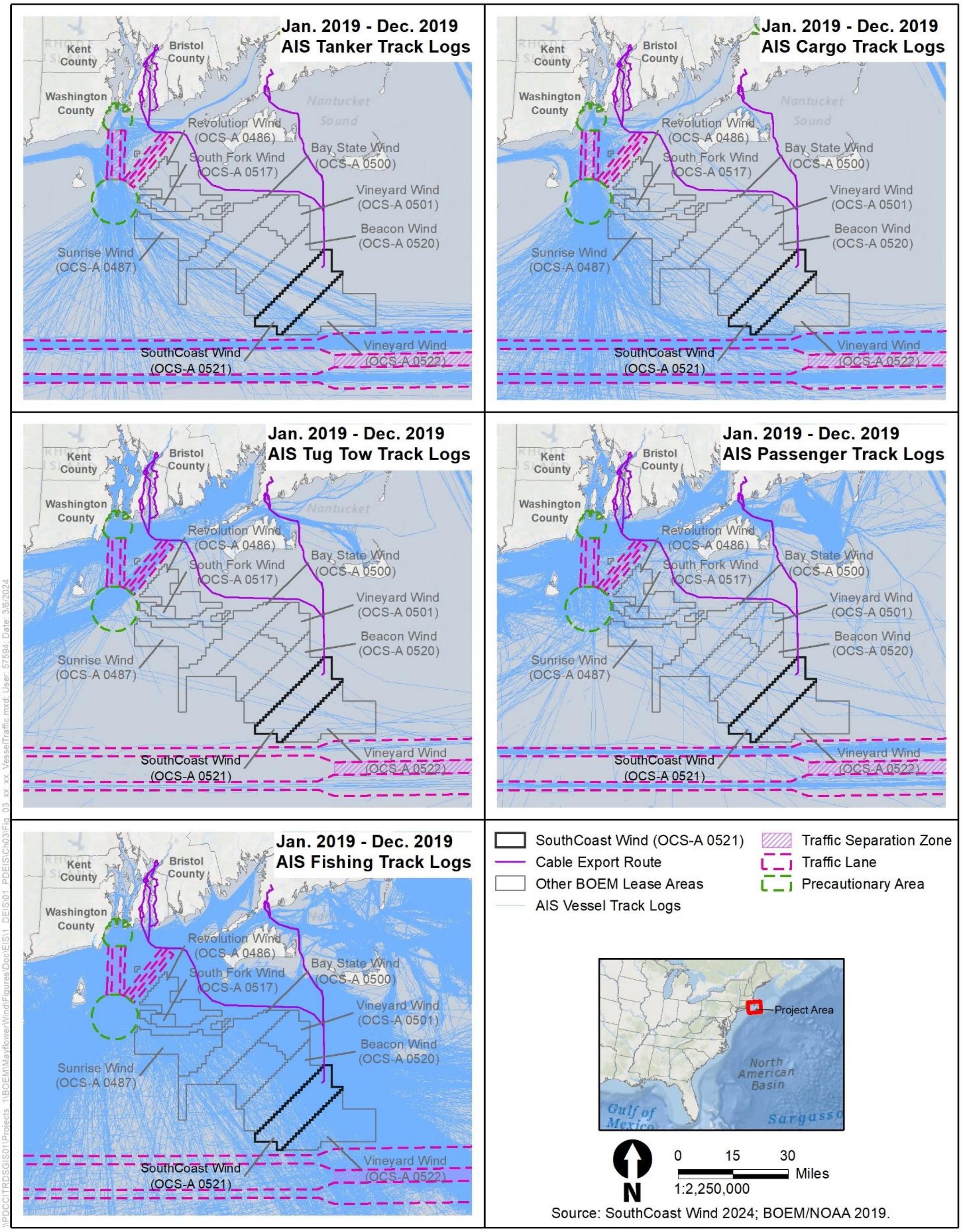


Figure 3.6.6-2. Vessel traffic in the vicinity of the Lease Area

Most commercial vessels, such as cargo vessels, carriers, and tankers, make use of the two Traffic Separation Systems on approach to and departure from ports. The majority of deep-draft vessel transits occur in the traffic lanes along the southern edge of the geographic analysis area within the Nantucket Ambrose Fairway (Figure 3.6.6-2) (COP Appendix X, Section 2.1.1.1; SouthCoast Wind 2024). To the northeast and east of the Project area, the International Maritime Organization has designated Nantucket Shoals, a shallow area that presents hazards for deep-draft vessels, as an Area to be Avoided.

The USCG prepares port access route studies to review potential traffic density and the need for safe access routes for vessels. MARIPARS is the primary study relevant to the geographic analysis area, which provides recommendations regarding offshore wind energy development in the Rhode Island and Massachusetts Wind Energy Areas (USCG 2020). The recommendations include development of WTGs along a standard and uniform grid pattern with standard spacing to accommodate vessel transits and fishing operations. In December 2021, USCG released the Northern New York Bight port access route study, which recommends combining the two separate Nantucket-Ambrose lanes south of the Lease Area into a single fairway (USCG 2021a).

Vessel Traffic

There is wide variance in traffic density, vessel types, and vessel sizes in the geographic analysis area. The sources employed to identify vessel traffic patterns in the NSRA include Nationwide AIS data for 2019, VMS data from NMFS through 2016, vessel trip report data from 2011 to 2015, the MARIPARS (USCG 2020), and interactions with recreational boating, fishing, and towing industry organizations, agencies, and other stakeholders. Based on the information in the NSRA, vessel traffic in the northern portion of the geographic analysis area (within Nantucket Sound, the Sakonnet River, and Mount Hope Bay) comprises smaller vessels with a high seasonal influence. The vessel traffic in the southern portion of the analysis area, which encompasses the Lease Area, is more varied, with a mixture of deep-draft vessels and commercial fishing vessels engaged in fishing or transiting to fishing grounds outside the Project area.

Table 3.6.6-1 shows the number of vessel tracks that intersected the Lease Area and offshore export cable routes based on AIS data from NOAA Office for Coastal Management from January 1, 2019 to December 31, 2019. As per USCG (33 CFR 164.46), AIS is required on several types of vessels including commercial vessels with a length of 65 feet (19.8 meters) or longer. While some smaller recreational and fishing vessels carry AIS, the data in the table most likely underrepresents vessels less than 65 feet (19.8 meters) long that traverse the Project area. Nonetheless, over 75 percent of AIS tracks in the Project area were from fishing and pleasure vessels.

Table 3.6.6-1. Vessel tracks in the Offshore Project area (January 1–December 31, 2019)

Vessel Type	Vessel Tracks	Percent of Total
Cargo	163	1%
Fishing [a]	11,303	38%
Passenger	2,803	9%
Pleasure Craft/Sailing [b]	11,251	38%
Tanker	180	1%
Tug/Tow	1,708	6%
Other/Not Available [b]	2,326	8%
Total	**29,734**	**100%**

Source: Office for Coastal Management 2022.
[a] AIS track counts for fishing and pleasure vessels underrepresent these vessel types, as not all of these vessel types are required to have AIS on board per USCG regulations.
[b] Other/Not Available vessel types include research, military, law enforcement, and unspecified vessels.

Most cargo, carrier, and tanker vessel traffic in the geographic analysis area use the Nantucket Ambrose Fairway and Narragansett Bay Traffic Separation System. The densest vessel tracks are within the Nantucket Ambrose Fairway, located between the approaches to New York and waters south of Nantucket. Some deep-draft vessels cross the Lease Area when transiting between the Nantucket Ambrose Fairway and the Narragansett Bay Traffic Separation System. Minimal cargo and tanker activity occurs in the Sakonnet River and Rhode Island Sound, with slightly higher activity in Mount Hope Bay (COP Volume 2, Section 13.1.1; SouthCoast Wind 2024).

In the geographic analysis area, the area with the most commercial fishing vessel traffic is in the northwest-southeast corridor from Martha's Vineyard and along Nantucket Shoals intersecting the Falmouth ECC. Near the Brayton Point ECC, the most commercial fishing activity occurs in Rhode Island Sound with limited activity in Mount Hope Bay and the Sakonnet River, with the exception of high levels of monkfish fishing and limited gillnet fishing (COP Volume 2, Section 13.1.1; SouthCoast Wind 2024).[4]

Most passenger vessels present in the geographic analysis area occur between Cape Cod, Martha's Vineyard, and Nantucket. There are also cruise ships that transit the Nantucket Ambrose Fairway and some pleasure vessel transits in Nantucket Sound and Rhode Island Sound, the Sakonnet River, and Mount Hope Bay (COP Volume 2, Section 13.1.1; SouthCoast Wind 2024).

Vessel Incidents

The NSRA modeled baseline vessel incidents based on vessel traffic patterns without the Proposed Action. Expected and modeled accident frequencies in the Lease Area for allision are zero, as there are

[4] As described in Chapter 2, Section 2.1.2, *Alternative B – Proposed Action,* Brayton Point is the preferred POI for both Project 1 and Project 2, and Falmouth is the variant POI for Project 2, which would be used if SouthCoast Wind is prevented from using Brayton Point for Project 2.

currently no wind turbines in the Lease Area that present a risk for allision. The accident frequency for collisions is 0.005 accident per year, or 5 accidents in 1,000 years. The greatest collision risk is from groundings, with an accident frequency of 0.058 accident per year. Most of the overall accident frequency (90 percent) is from fishing vessels, which transit close to the shoreline (COP Appendix X, Section E.3.1; SouthCoast Wind 2024).

Aids to Navigation

The closest federal aid to navigation to the Lease Area is the Muskeget Channel "MC" buoy, which is approximately 21 nm (39 kilometers) from the Lease Area and marks the southern entrance to the channel (COP Appendix X; SouthCoast Wind 2024). Additional federal and private aids to navigation are located in proximity to the Falmouth offshore ECC in Nantucket Sound and the Brayton Point offshore ECC in the Sakonnet River and Mount Hope Bay. Aids to navigation are developed by the USCG to assist mariners in determining their position and identifying safe courses and to warn of dangers and obstructions.

Ports, Harbors, and Navigation Channels

The major ports in the vicinity of the Project area include the ports of Providence and Davisville in Rhode Island, and the ports of Fall River and New Bedford in Massachusetts. These ports serve the commercial fishing industry, passenger cruise lines, cargo and other maritime activities. Of these, the largest deep-draft port by volume is Providence Port. The primary vessel traffic and commercial shipping lanes to these ports are outside the Lease Area. Other ports in the geographic analysis area include the Port of Salem, Massachusetts; Port of New London, Connecticut; Sparrows Point, Maryland; Charleston, South Carolina; and Corpus Christi, Texas.

3.6.6.2 Impact Level Definitions for Navigation and Vessel Traffic

Definitions of impact levels are provided in Table 3.6.6-2. There would be no beneficial impacts on navigation and vessel traffic.

Table 3.6.6-2. Impact level definitions for navigation and vessel traffic

Impact Level	Impact Type	Definition
Negligible	Adverse	No measurable impacts would occur.
Minor	Adverse	Impacts would be small, localized, and temporary. Normal or routine functions associated with vessel navigation would not be disrupted.
Moderate	Adverse	Impacts would be unavoidable. Vessel traffic would have to adjust somewhat to account for disruptions due to impacts of the Project.
Major	Adverse	Vessel traffic would experience unavoidable disruptions to a degree beyond what is normally acceptable, including potential loss of vessels and life.

3.6.6.3 Impacts of Alternative A – No Action on Navigation and Vessel Traffic

When analyzing the impacts of the No Action Alternative on navigation and vessel traffic, BOEM considered the impacts of ongoing activities, including ongoing non-offshore wind and ongoing offshore wind activities on the baseline conditions for navigation and vessel traffic. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities, as described in Appendix D*, Planned Activities Scenario*.

Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for navigation and vessel traffic described in Section 3.6.6.1, *Description of the Affected Environment and Future Baseline Conditions,* would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities. Ongoing non-offshore wind activities that affect navigation and vessel traffic in the geographic analysis area include marine transportation, military use, NMFS activities and scientific research, and fisheries use and management. Impacts from these activities would increase vessel traffic in the area, adding to congestion in waterways and increasing the potential for maritime accidents.

Ongoing offshore wind activities within the geographic analysis area that contribute to impacts on navigation and vessel traffic include ongoing construction of the Vineyard Wind 1 project (62 WTGs and 1 OSP) in OCS-A 0501, the South Fork project (12 WTGs and 1 OSP) in OCS-A 0517, and the Revolution Wind project (65 WTGs and two OSPs) in OCS-A 0486. Ongoing construction of the Vineyard Wind 1, South Fork, and Revolution Wind projects would have the same type of impacts on navigation and vessel traffic that are described in *Cumulative Impacts of the No Action Alternative* for ongoing and planned offshore wind activities, but the impacts would be of lower intensity.

Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative in combination with other planned non-offshore wind activities and planned offshore wind activities (without the Proposed Action).

Other planned non-offshore wind activities that may affect navigation and vessel traffic in the geographic analysis area include port improvement projects, dredging projects, and installation of new structures on the OCS. These activities may result in a moderate increase in port maintenance activities, port upgrades to accommodate larger deep-draft vessels, and temporary increases in vessel traffic for offshore cable emplacement and maintenance. See Appendix D, *Planned Activities Scenario*, for a summary of potential impacts associated with ongoing and planned non-offshore wind activities by IPF for navigation and vessel traffic.

The sections below summarize the potential impacts of ongoing and planned offshore wind activities in the geographic analysis area on navigation and vessel traffic during construction, O&M, and decommissioning of the projects. Ongoing and planned offshore wind projects in the geographic analysis area that would contribute to impacts on navigation and vessel traffic include those projects in all or portions of OCS-A-0486 (Revolution Wind), OCS-A-0487 (Sunrise Wind), OCS-A-0500 (Bay State Wind), OCS-A 0501 (Vineyard Wind 1), OCS-A 0517 (South Fork Wind), OCS-A-0520 (Beacon Wind), OCS-A 0522 (Vineyard Wind Northeast), and OCS-A 0534 (New England Wind) (Table D2-1, Appendix D). BOEM expects other offshore wind development in the geographic analysis area to affect navigation and vessel traffic through the following IPFs.

Anchoring: Offshore wind developers are expected to coordinate with the maritime community and USCG to avoid laying export cables through any traditional or designated lightering/anchorage areas, meaning that any risk for deep-draft vessels would come from anchoring in an emergency scenario. In addition, cables would be identified on nautical charts, which vessel operators would be expected to consult prior to dropping anchor. Generally, larger vessels accidently dropping anchor on top of an export cable (buried or mattress protected) to prevent drifting in the event of vessel power failure would result in damage to the export cable, damage to the vessel anchor and/or anchor chain, and risks associated with an anchor contacting an electrified cable.

Smaller commercial or recreational vessels anchoring in the offshore wind lease areas may have issues with anchors failing to hold near foundations and any scour protection. Considering the small size of the geographic analysis area compared to the remaining area of open ocean near the Project area, as well as the low likelihood that any anchoring risk would occur in an emergency scenario, it is unlikely that offshore wind activities would affect vessel-anchoring activities, and impacts would likely be negligible.

Port utilization: Other offshore wind development would support planned expansions and modifications at ports in the geographic analysis area for navigation and vessel traffic. Simultaneous construction or decommissioning (and, to a lesser degree, operation) activities for multiple offshore wind projects in the geographic analysis area could stress port capacity and resources and could concentrate vessel traffic in port areas. Such concentrated activities could lead to increased risk of allision, collision, and vessel delay.

The increase in port utilization due to offshore wind activity would vary across ports and would depend on the specific port or ports supporting each offshore wind project. It is unlikely that all projects would use the same ports; therefore, the total increase in vessel traffic would be distributed across multiple ports in the region. Port utilization in the geographic analysis area would occur primarily during construction. Offshore wind construction activities may result in competition for berthing space and port services potentially causing short- to medium-term adverse impacts on commercial shipping. During peak activity, impacts on port utilization would be moderate, short term, and continuous at the ports and their maritime approaches.

After offshore wind projects are constructed, related port utilization would decrease. During operations, project-related port utilization would have minor, long-term, intermittent, localized impacts on overall vessel traffic and navigation. Port utilization would increase again during decommissioning at the end of the operating period of each project, which BOEM anticipates to be approximately 35 years, with magnitudes and impacts similar to those described for construction.

Presence of structures: Approximately 920 WTGs and OSPs would be constructed in the geographic analysis area that would pose navigational hazards to vessels transiting in and around areas leased for offshore wind projects. Offshore wind projects would increase navigational complexity and ocean space use conflicts, including the presence of WTG and OSP structures in areas where no such structures currently exist, potential compression of vessel traffic both outside and within offshore wind lease areas, and potential difficulty seeing other vessels due to a cluttered view field. All offshore wind projects would be required to light and mark their projects in compliance with the guidelines in BOEM's *Lighting and Marking Guidelines* (BOEM 2021), in addition to procuring valid PATON permits from USCG First District. The increasing presence of structures as new offshore wind farm areas are developed could lead to increased congestion and navigational complexity, which could result in increased allisions, collisions, and vessel fuel spills.

Another potential impact of offshore wind structures is interference with marine vessel radars, when in or near lease areas. The MARIPARS report notes (USCG 2020) that various factors play a role in potential marine radar interference by offshore wind infrastructure, stating that "the potential for interference with marine radar is site specific and depends on many factors including, but not limited to, turbine size, array layouts, number of turbines, construction material(s), and the vessel types." In the event of radar interference, other navigational tools are available to ship captains. BOEM expects the industry to adopt both technological and non-technology-based measures to reduce impacts on marine radar, including greater use of AIS and electronic charting systems, new technologies like LiDAR, employing more watchstanders,[5] and avoiding wind farms altogether.

The fish aggregation and reef effects of offshore wind structures would also provide new opportunities for recreational fishing. The additional recreational vessel activity focused on aggregation and reef effects would incrementally increase vessel congestion and the risk of allision, collision, and spills near WTGs. Overall, the impacts of this IPF on navigation and vessel traffic would be moderate, long term (as long as structures remain, approximately 35 years), regional (throughout the entire geographic analysis area for navigation and vessel traffic), and constant.

Cable emplacement and maintenance: Other offshore wind projects in the geographic analysis area would require installation of 3,520 miles (5,665 kilometers) of offshore export and interarray cables. Emplacement and maintenance of cables for these offshore wind projects would generate vessel traffic and would specifically add slower-moving vessel traffic above cable routes. Vessels not involved in cable emplacement or maintenance would need to take additional care when crossing cable routes during installation and maintenance activities. BOEM anticipates that there would likely be simultaneous cable-laying activities from multiple projects based on the estimated construction timeline. While simultaneous cable-laying activities may disrupt vessel traffic over a larger area than if activities

[5] Watchstander is a person on watch on a ship. Employing additional watchstanders and lookouts, particularly when navigating through or adjacent to a wind farm, could improve situational awareness (National Academies of Sciences, Engineering, and Medicine 2022).

occurred sequentially, the total time of disruption would be less than if each project were to conduct cable-laying activities sequentially. The impacts of this IPF on vessel traffic and navigation would be minor to moderate because impacts would be short term, localized, and most disruptive during peak construction activity of the offshore wind projects in 2024 and 2025.

Traffic: Offshore wind projects would generate vessel traffic during construction, operation, and decommissioning in the geographic analysis area. Other vessel traffic in the region (e.g., from commercial fishing, for-hire and individual recreational use, shipping activities, military uses) would overlap with offshore wind-related vessel activity in the open ocean and near ports supporting the offshore wind projects. BOEM anticipates that the total increase in vessel traffic would be distributed across multiple ports in the region.

Up to 12 offshore wind projects (number of projects includes lease remainders; see Appendix D, Table D-2) would be constructed in the geographic analysis area between 2023 and 2030. Based on the estimated construction schedules for these projects, vessel traffic would likely be highest between 2024 and 2025 when up to 10 projects could be under construction at the same time. For purposes of estimating total vessel traffic, BOEM assumed that construction vessel traffic for these projects would be similar to the Proposed Action of between 15 to 35 vessels operating at any given time (the Proposed Action proposes the most WTGs of any of the 12 other offshore wind projects in the geographic analysis area so this is a conservative assumption). At peak construction between 2024 and 2025, other offshore wind projects could generate between 150 and 350 vessels operating in and near the geographic analysis area. The presence of offshore wind project vessels would add to the overall Atlantic Coast vessel traffic levels as new offshore wind farm areas are developed, leading to increased collisions and allisions, and vessel fuel spills. Increased offshore wind-related vessel traffic during construction would have moderate, short-term, constant, localized impacts on overall (wind and non-wind) vessel traffic and navigation.

After offshore wind projects are constructed, related vessel activity would decrease. Vessel activity related to the operation of offshore wind facilities would consist of scheduled inspection and maintenance activities with corrective maintenance as needed. For purposes of estimating total operational vessel traffic in the geographic analysis area, BOEM assumed that vessel traffic for these projects would be similar to the Proposed Action estimates of one to three vessels per day. Combined, the 12 offshore wind projects in the geographic analysis area would generate approximately 36 vessels per day during normal O&M beginning in 2030. During operations, project-related vessel traffic would have minor, long-term, intermittent, localized impacts on overall vessel traffic and navigation. Vessel activity would increase again during decommissioning at the end of the assumed 35-year operating period of each project, with magnitudes and impacts similar to those described for construction.

Conclusions

Impacts of the No Action Alternative: BOEM expects ongoing activities, including non-offshore wind and offshore wind activities to have continuing short- and long-term impacts on navigation and vessel traffic, primarily through the presence of structures, port utilization, and vessel traffic. BOEM anticipates that the impacts of ongoing activities, especially port utilization, presence of structures, and vessel traffic, would be **moderate adverse**.

Cumulative Impacts of the No Action Alternative: Under the No Action Alternative, existing environmental trends and ongoing activities would continue, and navigation and vessel traffic would continue to be affected by the primary IPFs of port utilization, presence of structures, cable emplacement, and vessel traffic. Planned non-offshore wind activities, including port improvement projects, dredging projects, and offshore cable emplacement and maintenance, would contribute to impacts on navigation and vessel traffic.

Planned offshore wind activities would increase vessel activity, which could lead to congestion at affected ports, the possible need for port upgrades beyond those currently envisioned, and an increased likelihood of collisions and allisions, with resultant increased risk of accidental releases. The planned construction of offshore wind projects would add new structures in areas where no such structures currently exist, increasing the risk for collisions, allisions, and resultant accidental releases and threats to human health and safety. BOEM anticipates that the cumulative impacts of the No Action Alternative would result in **moderate adverse** impacts primarily due to the presence of structures.

3.6.6.4 Relevant Design Parameters and Potential Variances in Impacts

This EIS analyzes the maximum-case scenario; any potential variances in the proposed Project build-out as defined in the PDE would result in impacts similar to or less than those described in the sections below. The following proposed PDE parameters (Appendix C, *Project Design Envelope and Maximum-Case Scenario*) would influence the magnitude of the impacts on navigation and vessel traffic.

- The Project layout including the number, type, and placement of the WTGs and OSPs including the location, width, and orientation of the Wind Farm Area rows and columns.
- The number of vessels used for construction and installation.
- The offshore electric cable corridor routes/locations.
- Time of year of construction.
- Ports selected to support construction and installation and O&M.

SouthCoast Wind has committed to measures to minimize impacts on navigation and vessel traffic, which include, but are not limited to, implementing construction safety zones in consultation with USCG, using on-scene safety vessel(s) and/or personnel to advise mariners of construction activity, as necessary, and marking of structures to align with letter and number marking of all offshore structures within the Massachusetts and Rhode Island wind energy area, improving general navigation (COP Volume 2, Table 16-1; SouthCoast Wind 2024).

3.6.6.5 Impacts of Alternative B – Proposed Action on Navigation and Vessel Traffic

Impacts from the Proposed Action alone would include increased vessel traffic in and near the Wind Farm Area and on the approach to ports used by the Proposed Action, as well as obstructions to navigation caused by Proposed Action activity. COP Volume 1, Table 3-21 and Table 3-23 (SouthCoast Wind 2024) summarize the anticipated Project-related vessel traffic during construction and O&M, respectively.

Changes in traffic from the Project are anticipated to include the following.

- Project-related vessel traffic related to construction, O&M, and decommissioning activities.
- Additional non-Project traffic that might be generated by the presence of the Wind Farm Area, for example, pleasure vessel trips for sight-seeing or recreational fishing.
- The modification of usual traffic routes for some ship types due to the presence of wind farm structures.

The NSRA risk analysis modeled the frequency of non-Project vessel accidents that could result from installation of the Proposed Action wind farm structures. The model estimates frequencies for marine accidents accounting for Project- and location-specific environmental, traffic, and operational parameters. Baseline vessel traffic data used in the model are described in Section 3.6.6.1, *Description of the Affected Environment and Future Baseline Conditions*. Detailed information about the risk analysis is included in COP Appendix X (SouthCoast Wind 2024). The risk analysis calculated the frequency of hazards due to drift allision, powered allision, drift grounding, powered grounding, and collision. Results of the NSRA risk modeling are described below under the IPF headings for *Presence of Structures* and *Traffic*.

Anchoring: The nearest established anchorage to the Lease Area is Anchorage G located 13 nm (24 kilometers) to the north. As indicated by AIS data, there is no significant anchorage activity in the vicinity of the Lease Area. Therefore, construction and operation of the Wind Farm Area is not anticipated to have a measurable effect on navigation and safety related to anchorages (COP Appendix X, Section 2.2.3.1; SouthCoast Wind 2024). Smaller vessels anchoring in the Wind Farm Area may have issues with anchors failing to hold near foundations and any associated scour protection, or, alternately, where the anchors may become snagged and potentially lost. During construction, installation, and decommissioning operations, smaller recreational and fishing vessels would most likely not transit the Wind Farm Area and, therefore, not anchor in the geographic analysis area. Consequently, any potential impacts from smaller vessels anchoring in the Wind Farm Area would primarily occur during the O&M phase.

There are several anchorage areas in proximity to and overlapping the proposed offshore export cable routes (COP Appendix X, Figure 2-35; SouthCoast Wind 2024). The Falmouth offshore export cable route would cross Anchorages G, H, and I (in and around Nantucket Sound), and the Brayton Point offshore export cable route would pass in proximity to Anchorages E and F (in and around Vineyard Sound). Based on AIS data, these anchorages would likely be used mostly by smaller vessels such as passenger and pleasure crafts (COP Appendix X, Figure 2-25; SouthCoast Wind 2024). Anchors for these vessels are unlikely to penetrate to the depth that would make contact with the buried cable. Additionally, cables would be charted and SouthCoast Wind would take into consideration anchoring impacts in cable design in areas where anchoring may occur, reducing the potential for anchoring impacts (COP, Section 3.4.1.1.1; SouthCoast Wind 2024).

Deviations from "normal" anchorage activities, such as vessels anchoring in an emergency scenario, pose a potential hazard to subsea cables. Depending upon the anchor weight, vessels with a tonnage greater than 10,000 deadweight tonnage (DWT) would be the most likely to carry anchors that could penetrate to the Project cable burial depth if anchoring in an emergency scenario in the vicinity of the ECC (Sharples 2011). For comparison, 2019 AIS data indicates the average passenger or pleasure vessel in the geographic analysis area is less than 1,000 DWT (COP Appendix X, Figure 2-28; SouthCoast Wind 2024). However, anchor penetration is dependent upon factors other than ship size and anchor weight, such as the type of soil on the seabed and whether the anchor is dragged after the initial drop (Sharples 2011). SouthCoast Wind has conducted a Cable Burial Risk Assessment to calculate the target cable lowering depth to minimize risks to the offshore export cables from damage, and to mitigate potential conflicts between commercial or recreational fishermen and the new structure (COP Volume 2, Section 11.2.3.2; SouthCoast Wind 2024). To minimize conflicts between fishing gear and the proposed Project's interarray and offshore export cables, the interarray cables would be buried at a depth of 3.2 to 8.2 feet (1.0 to 2.5 meters), and the offshore export cables would be buried at a depth of 3.2 to 13.1 feet (1.0 to 4.0 meters). A cable burial depth targeted at 5 to 6 feet (1.5 to 1.8 meters) has resulted in cable interactions approaching zero incidents, based on observations in the U.S. telecommunications industry since 2000 (North American Submarine Cable Association 2019).

If sufficient burial depth cannot be achieved, armoring or other cable protection would be used to protect cables from external damage. Cable protection methods may include rock placement, concrete mattresses, frond mattresses, rock bags, and seabed spacers (COP Volume 1, Section 3.3.5.3; SouthCoast Wind 2024). In the event an anchor does make contact with a buried export cable, impacts could include damage to the export cable and potential damage to the vessel anchor and/or anchor chain. Depending on the extent of the damage to the export cable the risks associated with an anchor contacting an electrified cable can pose issues to Project equipment (an overload and shut-down of converter or transformer stations) but is not going to cause electrical shock to the ship involved since seawater is a good conductor of electricity (Sharples 2011). If the export cable is damaged to the point of requiring repair, there could be impacts associated with additional vessel activity to conduct damage assessment and repair. Secondary impacts are repercussions on the vessel operator's liability and insurance. Combined with the low likelihood that any anchoring would occur in an emergency scenario, impacts on navigation and vessel traffic would be negligible.

Port utilization: The Proposed Action is considering multiple ports for construction including New Bedford, Fall River, and Salem, Massachusetts; Davisville and Providence, Rhode Island; New London, Connecticut; Sparrows Point, Maryland; Charleston, South Carolina; Corpus Christi, Texas; as well as some international ports, including the Port of Altamira, Mexico and ports in Canada. O&M vessel trips would originate primarily from the ports of New Bedford and Fall River, Massachusetts; New London, Connecticut, or Providence, Rhode Island, with the potential for occasional repair and supply delivery trips originating from ports in Davisville and Providence, Rhode Island; Salem, Massachusetts; Sparrows Point, Maryland; and Charleston, South Carolina. The Proposed Action would generate trips by support vessels, such as crew transports vessels, hotel vessels, tugs, and miscellaneous vessels, which would increase congestion at ports, especially during construction and decommissioning. Construction of the Proposed Action would generate on average 15 to 35 vessels (with a maximum peak of 50 vessels) operating in the Wind Farm Area or over the offshore ECC route at any given time (COP Volume 1, Table 3-21; SouthCoast Wind 2024). On average, the Proposed Action would generate approximately one to three vessel trips per day between the Lease Area and ports during regular operations. The presence of these vessels could cause delays for non-Proposed Action vessels and could cause some fishing or recreational vessel operators to change routes or use an alternative port. The Proposed Action's impacts on vessel traffic due to port utilization would be moderate, short term, and continuous through construction and installation. During O&M, impacts would be minor, long-term, and intermittent. Impacts would increase to moderate for decommissioning comparable to construction and installation impacts.

Presence of structures: The Proposed Action would include up to 147 WTGs and 5 OSPs, for up to 149 structure positions, operating for approximately 35 years in the Wind Farm Area where no such structures currently exist. The 149 positions would conform to a 1-nm-by-1-nm (1.9-kilometer-by-1.9-kilometer) grid layout with an east–west and north–south orientation across the entire Massachusetts and Rhode Island lease areas, as agreed upon by SouthCoast Wind and other leaseholders. This uniform grid pattern and spacing is consistent with recommendations in the MARIPARS final report concerning WTG layout (USCG 2020) and minimizes the risks of vessel accidents and space use conflicts in the Wind Farm Area.

Proposed Action structures would increase the risk of allision, as well as collision with other vessels navigating through WTGs and could interfere with marine radars (although other navigation tools are available to ship captains). Nearly all vessels that travel through the Wind Farm Area would need to navigate with greater caution under the Proposed Action to avoid WTGs and OSPs; however, there would be no restrictions on use or navigation in the geographic analysis area. WTGs with approved lighting and marking could serve as additional aids to navigation. SouthCoast Wind intends to submit requests to USCG for up to 149 PATONs, one for each of the WTG or OSP positions. Many vessels that currently navigate that area would continue to be able to navigate through the geographic analysis area safely. Vessels that exceed a height of 75.5 feet (23 meters) would be at risk of alliding with WTG blades at mean high water, and would need to navigate around the Wind Farm Area or navigate with caution through the Wind Farm Area to avoid the WTGs. Cargo/carrier, tanker, cruise ships, and tug vessels are anticipated to choose routes around the turbine array (COP Appendix X, Section 2.3; SouthCoast Wind 2024).

While some non-Project vessel traffic may navigate through the Project area, many vessels would most likely choose not to pass through the area during construction (due to the presence of construction-related activities and the emergence of fixed structures), during the life of the Project (due to the presence of fixed structures), and during decommissioning. NSRA modeled the frequency of marine accidents under the Proposed Action assuming there would be a rerouting of common vessel traffic routes around the Wind Farm Area for cargo/carrier, tankers, passenger (cruise ships), and tugs. NSRA assumed that other vessel types, including fishing, pleasure and other vessels, would not reroute around the Wind Farm Area. The primary increase in marine accidents (derived by comparing future-case with base-case vessel traffic conditions) related to the presence of structures would be due to drift allision, resulting in an increase of 0.215 accident per year, and powered allision, resulting in an increase in 0.138 accident per year (COP Appendix X, Table E-40; SouthCoast Wind 2024). The estimated increase in allision accident frequency is attributed to those vessel types that would not reroute around the Project area (fishing, other, and pleasure). Cargo, tugs, and tankers would experience only a minor increase in allision frequency.

O&M of the Proposed Action would likely affect marine vessel radar performance near or within the Wind Farm Area. National Academies of Sciences, Engineering, and Medicine (2022) notes that WTG interference decreases the effectiveness of marine vessel radar mounted on all vessel classes. There is currently no standard system of active radar tailored to a WTG environment. Smaller vessels operating in the vicinity of the Project may experience the same challenges as larger vessels if equipped with marine vessel radar, such as clutter due to the WTGs or ambiguous detections, and may also be harder to identify as distinct targets or become lost contacts by larger vessels while in the proximity of WTGs (National Academies of Sciences, Engineering, and Medicine 2022). While radar is one of several navigational tools available to vessel captains, including navigational charts, GPS, and navigation lights mounted on the WTGs, radar is the main tool used to help locate other nearby vessels that are not otherwise visible particularly in adverse weather when visibility is limited. The navigational complexity of transiting through the Wind Farm Area, including the potential effects of WTGs and OSPs on marine radars, would increase risk of collision with other vessels (including non-Project vessels and Proposed Action vessels). Overall, the Proposed Action would have a long-term, continuous, moderate impact on navigation and vessel traffic.

Cable emplacement and maintenance: The Proposed Action would require the installation of offshore export cables and interarray and substation interconnector cables (COP Volume 1, Table 3-14; SouthCoast Wind 2024). The presence of slow-moving (or stationary) installation or maintenance vessels would increase the risk of collisions and spills. Offshore export cable installation activities include site preparation, such as sand wave and boulder clearance. In areas where sand waves are present, multiple passes may be required. Vessels engaged in cable emplacement are, by definition, restricted in their ability to maneuver and other power-driven vessels must give way.[6] Cable-laying vessels would display lights at nighttime, or day shapes during the daytime to communicate with other vessels that they are restricted in their ability to maneuver. USCG "Local Notice to Mariners" may also include information affecting local waterways, such as cable emplacement activity. Vessels not involved in cable emplacement or maintenance would need to take additional care when crossing cable routes or avoid installation or maintenance areas entirely during installation and maintenance activities. Depending on the exact route of the Falmouth and Brayton Point offshore export cables within the proposed corridors, cable-installation activities may temporarily affect private and federal aids to navigation. SouthCoast Wind has committed to implementing construction safety zones for offshore export cable installation in consultation with the USCG, which would include consulting in regard to potential impacts on aids to

[6] International Regulations for Preventing Collisions at Sea, 1972 (72 COLREGS), rules 3, 18, and 27.

navigation. Installation and maintenance of submarine cables would have minor to moderate, localized, short-term, intermittent impacts on navigation and vessel traffic.

Traffic: Construction of the Proposed Action could generate between 15 and 35 vessels operating in the Lease Area or over the offshore export cable route at any given time (COP Volume 1, Table 3-21; SouthCoast Wind 2024). Various vessel types would be deployed throughout the Offshore Project area during the construction and installation phase, increasing the risk of allisions and collisions. During offshore export cable route construction, non-Project vessels required to travel a more restricted (narrow) lane could potentially experience greater delays waiting for cable-laying vessels to pass. Non-Project vessels transiting between the Proposed Action ports and the Project area would be able to avoid Proposed Action vessels, components, and any safety zones (where USCG is authorized and elects to establish such zones)[7] through routine adjustments to navigation. The Proposed Action's construction and installation vessel traffic would have moderate, localized, short-term impacts on overall navigation and vessel traffic in opens waters and near ports.

Operation of the Proposed Action would generate approximately one to three trips per day from O&M ports to the Wind Farm Area. Vessel traffic generated by the Proposed Action could restrict maneuvering room and cause delays accessing the port. Although vessel traffic in the Lease Area is expected to decrease once the WTGs and OSPs are in place, O&M of the Proposed Action would result in the same types of vessel traffic and navigation impacts as those described during construction. Operation of the Proposed Action would have minor, long-term, intermittent, and localized impacts on overall navigation and vessel traffic near ports and in open waters.

The NSRA risk modeling suggests that under the Proposed Action, accident frequency would increase by 0.357 marine incident per year, an average of 1 additional accident every 2.8 years (COP Appendix X, Section 11.1-1; SouthCoast Wind 2024). Marine accidents involving fishing vessels represent 70 percent of the increase (Table 3.6.6-3). The increase in accident frequency represents all accidents, including accidents with small and zero consequence, such as bumping into a Project structure while drifting.

[7] Under the current captain of the Port Authority, USCG does not regulate the safety and security risks associated with the construction and operation of Offshore Renewable Energy Installations beyond 12 nm (USCG 2021b).

Table 3.6.6-3. NSRA modeled change in accident frequencies from the Proposed Action

Vessel Type	Increase in Frequency (number per year)	Percentage of Total (%)
Cargo/Carrier	0.012	3.4
Fishing	0.248	69.5
Other/Undefined	0.057	16.0
Passenger	0.003	0.9
Pleasure	0.029	8.1
Tanker	0.002	0.5
Tanker - Oil	0.005	1.4
Tug/Service	0.001	0.2
Total	**0.357**	**100**

Source: COP Appendix X, Table ES-1; SouthCoast Wind 2024.

Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned non-offshore wind activities and ongoing and planned offshore wind activities. Ongoing and planned non-offshore wind activities related to marine transportation, military use, NMFS activities and scientific research, and fisheries use and management would contribute to impacts from increased vessel traffic, adding to congestion in waterways and increasing the potential for maritime accidents. The construction, O&M, and decommissioning of offshore wind activities would contribute to impacts on navigation and vessel traffic through the primary IPFs of anchoring, port utilization, presence of structures, cable emplacement and maintenance, and traffic.

The combined impacts of the Proposed Action and other ongoing and planned offshore wind activities on navigation and vessel traffic from anchoring would be short term and minor due to the small size of the offshore wind lease areas compared to the remaining area of open ocean, as well as the low likelihood that any anchoring risk would occur in an emergency scenario.

Other offshore wind projects would generate comparable types and volumes of vessel traffic in ports and would require similar types of port facilities as the Proposed Action. In the geographic analysis area, the Proposed Action could overlap in construction with 10 other offshore wind projects in 2024 and 2025. The increase in port utilization due to other offshore wind project vessel activity would be limited during construction and installation of the Proposed Action. It is unlikely that all projects would use the same ports; therefore, the total increase in vessel traffic would likely be distributed across multiple ports in the region. However, there could be delays for vessels using those ports if two or more projects are under construction at the same time. Accordingly, combined port utilization impacts on navigation and vessel traffic from ongoing and planned activities, including the Proposed Action, would be continuous and moderate.

The construction of 1,048 structures under the Proposed Action and the other offshore wind projects in the geographic analysis area would increase the navigational complexity in the region, resulting in an increased risk of collisions and allisions and overall moderate impacts.

Cable installation and maintenance for other offshore wind activities would generate comparable types of impacts to those of the Proposed Action for each offshore export cable route and interarray and interconnector cable system. Simultaneous construction of export and interarray cables of other offshore wind projects would have an additive effect, although it is assumed that installation vessels would only be present above a portion of a project's cable system at any given time. Substantial areas of open ocean are likely to separate simultaneous offshore export and interarray cable installation activities for other offshore wind project. The combined impacts from ongoing and planned activities, including the Proposed Action, on navigation and vessel traffic from cable installation and maintenance would be localized, short term, intermittent, and minor.

Other offshore wind projects in the geographic analysis area would contribute similar impacts from increased vessel traffic associated with construction and operation. Construction of the Proposed Action would overlap with the construction of 10 other offshore wind projects. During peak construction activity between 2024 and 2025, the Proposed Action and other projects could generate between 165 and 385 vessels operating in and near the geographic analysis area. Following construction, up to 13 offshore wind projects, including the Proposed Action, could operate in the geographic analysis area and generate 39 vessel trips per day. Traffic from these projects would likely be spread among multiple ports within and outside of the geographic analysis area for navigation and vessel traffic, thus potentially moderating the effect of offshore wind-related vessel traffic at any single location. The contribution of the Proposed Action to vessel traffic impacts from ongoing and planned activities would be moderate, localized, short term, and intermittent.

Conclusions

Impacts of the Proposed Action: Construction and installation, O&M, and decommissioning of the Proposed Action would have adverse impacts on navigation and vessel traffic. The impacts of the Proposed Action alone on navigation and vessel traffic would be **moderate adverse**. Impacts on non-Project vessels would include changes in navigation routes, delays in ports, and degraded communication and radar signals, all of which would increase navigational safety risks. Some commercial fishing, recreational, and other vessels would avoid the Wind Farm Area altogether, leading to potential congestion of vessel traffic along the Project area borders.

Cumulative Impacts of the Proposed Action: In context of reasonably foreseeable environmental trends, the combination of the Proposed Action and other ongoing and planned activities would result in **moderate adverse** impacts on navigation and vessel traffic. The main IPF is the presence of structures, which would increase the risk of collision/allision and navigational complexity, particularly when adjoining offshore wind projects do not share a common WTG layout or spacing and do not include a separation between adjoining lease areas.

3.6.6.6 Impacts of Alternative C on Navigation and Vessel Traffic

Impacts of Alternative C: Routing the Brayton Point offshore export cable onshore to avoid sensitive fish habitat in the Sakonnet River under Alternatives C-1 and C-2 would slightly reduce the impacts on navigation and vessel traffic from between 9 and 12 fewer miles of cable installation activities, respectively. In the narrow navigable waterway of the Sakonnet River, this would reduce the potential for collisions with slow-moving cable-laying vessels, but any reduction in impacts would be temporary during installation and would not change the overall impact magnitude. Alternatives C-1 and C-2 would also avoid potential impacts on aids to navigation in the Sakonnet River, but any impacts from cable installation would be reduced or avoided through consultation with USCG, regardless of alternative, so impacts would not be meaningfully different between the Proposed Action and Alternatives C-1 or C-2.

Whereas the Alternative C-1 export cables would exit Aquidneck Island into Mount Hope Bay following the same route as the Proposed Action, the Alternative C-2 export cables would enter Mount Hope Bay on the east side of the Sakonnet River from Tiverton, Rhode Island. In Mount Hope Bay, Alternative C-2 would cross the Fall River Harbor Federal Navigation Channel Project in three locations (Figure 3.6.6-3). Federal navigation channels are waterways maintained by the USACE to allow vessels to transit confined nearshore areas and use ports or harbors. The vessel traffic in this area of the Fall River Harbor Federal Navigation Channel Project comprises primarily of shallow draft vessels including passenger and pleasure. Alternative C-2 would result in temporary disruption to vessels transiting the channel during the construction and installation phase and when maintenance activities are required during the O&M phase. As this area involves crossing the Fall River Harbor Federal Navigation Project, USACE will conduct dredging operations in the Federal Navigation Project at some point in the future. Therefore, any USACE Section 408 permission will require the cable placement to be at sufficient burial depth that it would not affect or impede future dredging operations. Crossing the federal navigation channel under Alternative C-2 would increase short- and long-term impacts compared to the Proposed Action, but the overall impact magnitude on navigation and vessel traffic is anticipated to be the same.

Cumulative Impacts of Alternative C: In context of reasonably foreseeable environmental trends, cumulative impacts of Alternatives C-1 and C-2 would be similar to those of the Proposed Action.

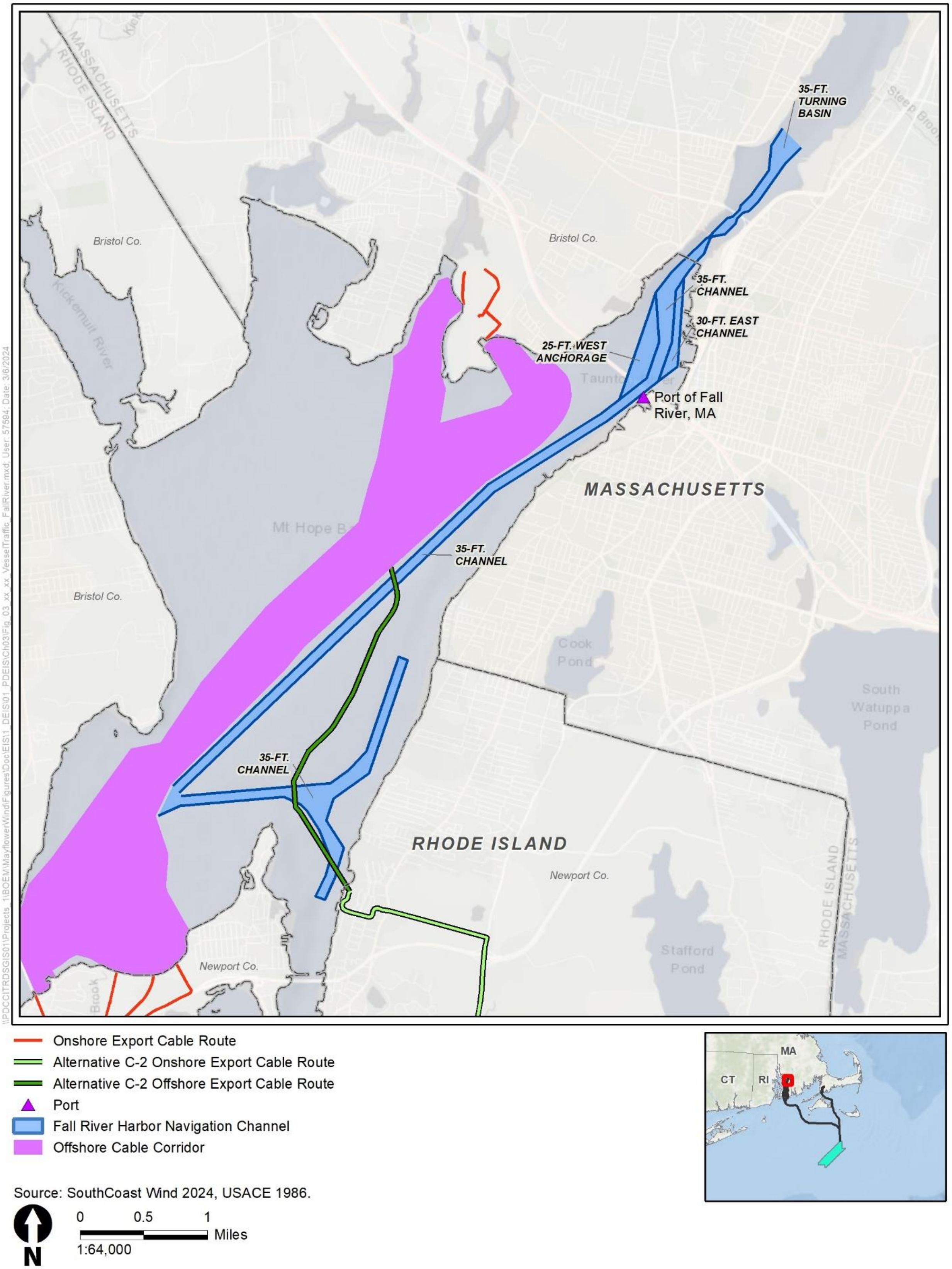


Figure 3.6.6-3. Alternative C-2 and the Fall River Harbor Federal Navigation Channel Project

Conclusions

Impacts of Alternative C: Alternative C-1 would avoid installing offshore export cable in the Sakonnet River, which would slightly reduce but not change the overall **moderate adverse** impact on navigation and vessel traffic compared to the Proposed Action. Alternative C-2 would also avoid installing offshore export cable in the Sakonnet River but would increase navigational impacts from crossing the Fall River Harbor Federal Navigation Channel Project. Impacts from Alternative C-2 would remain **moderate adverse**.

Cumulative Impacts of Alternative C: In context of reasonably foreseeable environmental trends, the cumulative impacts of Alternatives C-1 and C-2 would result in the same **moderate adverse** impacts on navigation and vessel traffic as the Proposed Action.

3.6.6.7 Impacts of Alternatives D (Preferred Alternative), E, and F on Navigation and Vessel Traffic

Impacts of Alternatives D, E, and F: The reduction in the number of WTGs under Alternative D, the use of specific foundation types under Alternative E, and the modifications to the offshore export cable routes under Alternative F would result in similar impacts as the Proposed Action on navigation and vessel traffic. Alternative D would exclude six WTGs in the northeast portion of the Lease Area nearest to Nantucket Shoals. Based on the 1-nm-by-1-nm spacing of the Lease Area, this 4 percent reduction in WTGs would leave up to 1.5 nm of open ocean at the edge of the Lease Area, which represents a small portion of the 25.5-nm length of the Lease Area (at its longest point). The WTG locations in Alternative D would incrementally decrease impacts on vessel traffic compared to the Proposed Action by providing additional space closer to Nantucket Shoals and coastal areas, which are more frequently used by fishing and recreational vessels. While Alternative D would decrease impacts on navigation and vessel traffic, it would not change the overall impact magnitudes described for the Proposed Action.

Under Alternative E, piled, suction bucket, and GBS foundations would be installed, respectively, which may slightly change the duration of foundation construction and the number of vessels, but any differences would be small and last only for the duration of construction. The overall impact on navigation and vessel traffic from the long-term presence of structures under Alternative E would not be substantively different than the Proposed Action. Under Alternative F, up to three cables would be used for the Falmouth offshore export cable, as opposed to the maximum of five cables proposed under the PDE. This may result in a slight reduction in cable-laying vessel construction activity, but overall impacts would be similar to those of the Proposed Action.

Cumulative Impacts of Alternatives D, E, and F: In context of reasonably foreseeable environmental trends, cumulative impacts of Alternatives D, E, and F would be similar to those of the Proposed Action.

Conclusions

Impacts of Alternatives D, E, and F: Alternatives D, E, and F would result in the same **moderate adverse** impacts on navigation and vessel traffic compared to the Proposed Action. By reducing the number of

WTGs in the northeast portion of the Lease Area, Alternative D would slightly reduce, but not change, the overall impact level on navigation and vessel traffic compared to the Proposed Action. The required use of specific foundation types under Alternative E would result in similar impacts as the Proposed Action. The reduction in the number of Falmouth offshore export cables under Alternative F would not have a meaningful difference in impacts compared to the Proposed Action.

Cumulative Impacts of Alternatives D, E, and F: In context of reasonably foreseeable environmental trends, the cumulative impacts associated with Alternatives D, E, and F would result in the same **moderate adverse** impacts on navigation and vessel traffic as the Proposed Action.

3.6.6.8 Comparison of Alternatives

Construction, O&M, and decommissioning of Alternatives C, D, E, and F would have the same negligible to moderate adverse impacts on navigation and vessel traffic as described under the Proposed Action. Although Alternative D would have reduced impacts due to the reduction in WTG positions, the magnitude of impacts would not be materially different from that of the Proposed Action. The installation of different foundation types under Alternative E may slightly change the duration of foundation construction and the number of vessels but would not affect the impact magnitude compared to the other alternatives. Similarly, restricting the number of cables to three for the Falmouth ECC would not have a meaningful change in impacts on navigation and vessel traffic. For Alternative C-1, the avoidance of the Sakonnet River by taking an onshore route on Aquidneck Island would minimize navigation impacts from the presence of installation vessels compared to other alternatives, but the reduction in impacts would be temporary. In contrast, Alternative C-2, while avoiding temporary navigation impacts in the Sakonnet River, would cross the Fall River Harbor Federal Navigation Channel Project in three locations and would increase short- and long-term impacts compared to the Proposed Action, although overall impact magnitude would remain the same.

3.6.6.9 Proposed Mitigation Measures

Additional mitigation measures identified by BOEM and cooperating agencies as a condition of state and federal permitting, or through agency-to-agency negotiations, are described in detail in Appendix G, Tables G-2 and G-3 and summarized and assessed in Table 3.6.6-4. If one or more of the measures analyzed here are adopted by BOEM or cooperating agencies, some adverse impacts on navigation and vessel traffic could be further reduced.

Table 3.6.6-4. BOEM or agency-proposed measures (also identified in Appendix G, Table G-3): navigation and vessel traffic

Measure	Description	Effect
Consult on aid to navigation impacts	Prior to cable installation, SouthCoast Wind would consult with the USCG regarding potential impacts on federal aids to navigation from cable installation and maintenance.	Requiring consultation with the USCG regarding cable emplacement would ensure impacts on aids to navigation are avoided during installation and maintenance of cables. This would mean aids to navigation would continue to serve their purpose for vessels in the area. Coordination with USCG would minimize impacts but the overall impact rating would not change.
Operations Center	SouthCoast Wind will operate a 24-hour operations center with direct communications with the USCG.	Requiring a 24-hour operations center with direct communications with the USCG would assist with addressing any real-time operational conflicts and/or safety issues. Coordination with USCG would minimize impacts but the overall impact rating would not change.
Mariner Communication and Outreach Plan	SouthCoast Wind would develop and implement a Mariner Communication and Outreach Plan that covers all Project phases from pre-construction to decommissioning and that facilitates coordination with all mariners, including the commercial shipping industry, commercial and for-hire fishing industries, and other recreational users. The Mariner Communication and Outreach Plan will include the following components: a. During Project design, coordinating in-water construction activities to avoid and minimize disruptions; b. At least 90 days prior to commencing in-water construction activities in any construction season, consultation with stakeholders on an approximate schedule of activities and existing uses within the Project area. Make good faith efforts to accommodate those existing uses. The results of these good	BOEM's requirement of a Mariner Communication and Outreach Plan would ensure that stakeholders and users of the affected waterways are kept informed of and have access to information related to all aspects of the project from preconstruction to decommissioning. Moreover, stakeholder feedback through consultations would inform project schedules potentially minimizing disruptions of scheduled activities and existing uses within the Project area during in-water construction activities. Although the measures within a mariner communication and outreach plan, if implemented, would potentially reduce the risk of vessel collisions and resultant oil spills, vessel traffic would still have to take action to avoid or mitigate any exposure to the construction, maintenance, and decommissioning activities taking place within their area of operation. Therefore, impacts would remain negligible to moderate for the Proposed Action and other action alternatives.

Measure	Description	Effect
	faith consultations can be summarized in a report and submitted to the federal agency(ies) prior to the start of each construction season; c. Following COP approval, notice of proposed changes which have the potential to impact fishing or maritime resources or activities; d. Notices to commence construction activities, conduct maintenance activities, and commence decommissioning; e. Status reports during construction with specific information on construction activities and locations for upcoming activities in the next 1–2 weeks; f. Post-construction notice of: (i) all cable protection measure locations (including protection type and charted location); (ii) any areas where the identified burial depth is less than target burial depth; and (iii) other obstructions to navigation created by the Project; and Post all notices described above to the Project website with information on how to opt-in for alerts.	

Measures Incorporated in the Preferred Alternative

BOEM has identified the additional measures in Table 3.6.6-4 as incorporated in the Preferred Alternative. These measures, if adopted, would reduce potential impacts on navigational safety, thereby reducing overall impacts on navigation and vessel traffic to moderate.

3.6 Socioeconomic Conditions and Cultural Resources

3.6.8 Recreation and Tourism

This section discusses potential impacts on recreation and tourism resources and activities from the proposed Project, alternatives, and ongoing and planned activities in the geographic analysis area. The geographic analysis area for recreation and tourism, as shown on Figure 3.6.8-1, corresponds to the scenic and visual resources geographic analysis area (Section 3.6.9, *Scenic and Visual Resources*) and includes a 42.8-mile (68.9-kilometer) buffer around the Lease Area, a 3-mile (4.8-kilometer) buffer around the onshore substation (associated with Falmouth POI) and/or converter station sites (associated with Brayton Point POI),[1] and a 0.5-mile (0.8-kilometer) buffer around the export cables. The geographic analysis area encompasses Barnstable, Bristol, Dukes, and Nantucket Counties in Massachusetts, and Bristol and Newport Counties, in Rhode Island. Section 3.6.3, *Demographics, Employment, and Economics*, discusses the economic aspects of recreation and tourism in the Project area.

3.6.8.1 Description of the Affected Environment

Regional Setting

Proposed Project facilities would be within and off the coast of Massachusetts and Rhode Island. The coastal areas support ocean-based recreation and tourist activities that include boating, swimming, surfing, scuba diving, sailing, and paddle sports. As indicated in Section 3.6.3, *Demographics, Employment, and Economics*, recreation and tourism contribute substantially to the economies of Massachusetts' and Rhode Island's coastal counties. Tourism in these coastal communities is a multibillion-dollar industry. There were 4,096,104 visits to the Cape Cod National Seashore in 2019 (COP Volume 2, Section 10.3.1.1.1; SouthCoast Wind 2024).

Coastal Massachusetts and Rhode Island have a wide range of visual characteristics, with communities and landscapes ranging from large cities to small towns, suburbs, rural areas, and wildlife preserves. As a result of the proximity of the Atlantic Ocean, as well as the views associated with the shoreline, the Massachusetts and Rhode Island shores have been extensively developed for water-based recreation and tourism.

The scenic quality of the coastal environment is important to the identity, attraction, and economic health of many of the coastal communities. Additionally, the visual qualities of these historic coastal towns, which include marine activities in small-scale harbors, and the ability to view birds and marine life are important community characteristics.

[1] As described in Chapter 2, Section 2.1.2, *Alternative B – Proposed Action*, Brayton Point is the preferred ECC for both Project 1 and Project 2, and Falmouth is the variant ECC for Project 2, which would be used if SouthCoast Wind is prevented from using Brayton Point for Project 2.

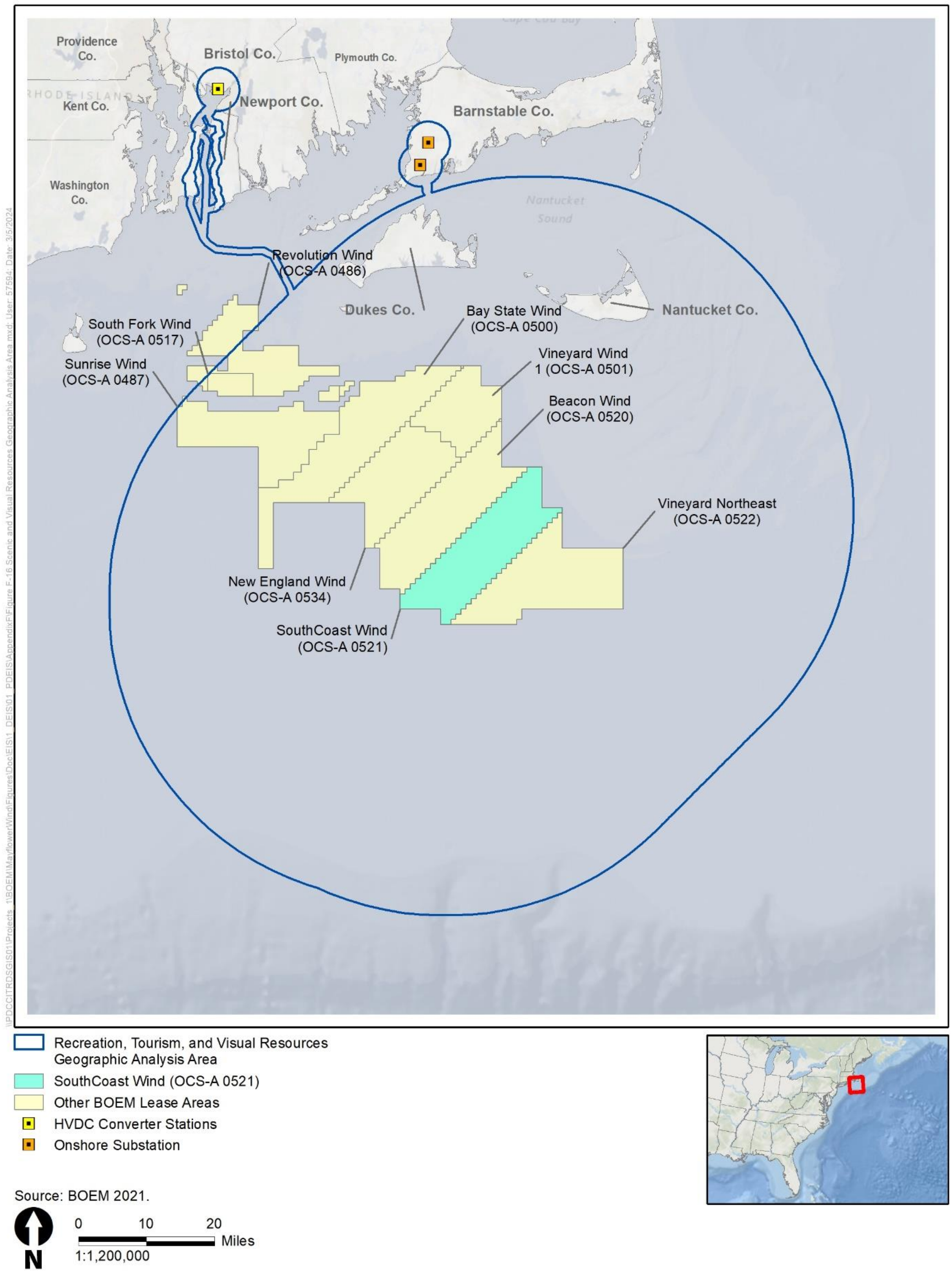


Figure 3.6.8-1. Recreation and tourism geographic analysis area

Project Area

Recreational and tourist-oriented activities are concentrated in the coastal communities in Barnstable, Bristol, Dukes, and Nantucket Counties in Massachusetts, and Bristol and Newport Counties, in Rhode Island. Coastal communities provide hospitality, entertainment, and recreation for hundreds of thousands of visitors each year. Although many of the coastal and ocean amenities, such as beaches, that attract visitors to these regions are accessible to the public for free and, thus, do not directly generate employment, these nonmarket features function as key drivers for recreation and tourism businesses.

Water-oriented recreational activities in the Project area include boating, visiting beaches, hiking, fishing, shellfishing, and bird and wildlife viewing. Boating covers a wide range of activities, from ocean-going vessels to small boats used by residents and tourists in sheltered waters, and includes sailing, sailboat races, fishing, shellfishing, kayaking, canoeing, and paddleboarding.

Commercial businesses offer boat rentals, private charter boats for fishing, whale watching and other wildlife viewing, and tours with canoes and kayaks. As discussed in Section 3.6.3, recreation and hospitality are major sectors of the economy in Barnstable, Bristol, Dukes, and Nantucket Counties in Massachusetts, and Bristol and Newport Counties, in Rhode Island, supported by the ocean-based recreation uses.

Inland recreational facilities are also popular but bear less of a relationship to possible impacts of the Project; this section does not address them in detail. These include inland waters, such as ponds and rivers, wildlife sanctuaries, golf courses, athletic facilities, parks, and picnic grounds.

Coastal and Offshore Recreation

Recreational boating activities occur along the coastline, especially during the summer months (COP Volume 2, Section 10.3.1.2.1; SouthCoast Wind 2024). Swimming and surfing are also popular during the summer months along the miles of white sand beaches. Surfers frequent several towns and cities along the coastline, including those in Cape Cod and the City of Newport (COP Volume 2, Sections 10.3.1.1.1 and 10.3.1.1.2.2; SouthCoast Wind 2024). Scuba diving and snorkeling are identified as popular uses offshore from the Cape Cod Peninsula with dive sites that include shipwrecks, artificial reefs, beach dives, and various inland sites (COP Volume 2, Sections 10.3.1.1.1 and 11.1.3.3.2; SouthCoast Wind 2024). The sailing and boating season typically runs from May to October with a peak in July and August and occurs both along the coastline, in the bays and inlets, as well as further off shore where long-distance sailing races are regularly held (McCann et al. 2013).

There is a large and robust recreational fishing industry in Massachusetts and Rhode Island. The *Fisheries Economics of the United States Report of 2019* estimates that recreational fishing had a $286 million impact on Massachusetts and Rhode Island's economy in 2019 (NOAA 2022a). Collectively, there were close to 2 million recreational angler trips (i.e., party boats, rental/private boats, and shore) made per year in Massachusetts and Rhode Island from 2007 to 2012 (COP Volume 2, Section 10.3.1.2.2; SouthCoast Wind 2024). Fishing activity mainly takes place along the coast near Falmouth, as well as

Tisbury and Oak Bluffs on Martha's Vineyard (COP Volume 2, Section 10.3.1.2.2; SouthCoast Wind 2024). There are also up to 60 saltwater fishing tournaments held annually during the summer in coastal towns. Saltwater fishing tournaments target a variety of fish Atlantic cod, black sea bass, bluefish, striped bass, haddock, and bluefin and yellowfin tuna (COP Volume 2, Section 10.3.1.2.2; SouthCoast Wind 2024). According to NOAA Fisheries One Stop Shop database, recreational anglers off the coast of Massachusetts and Rhode Island caught 133,509,942 pounds of fish in 2017; 23,735,123 pounds in 2018; 24,820,923 pounds in 2019; and 16,323,813 pounds in 2020 (NOAA 2022b).

NOAA's social indicator mapping tool (NOAA 2022d) identifies the importance or level of dependence of recreational fishing to coastal communities. The tool classifies communities based on recreational fishing reliance, which measures the presence of recreational fishing in relation to the population size of a community, and recreational fishing engagement, which measures the presence of recreational fishing through fishing activity estimates. Within the geographic analysis area, only one community, Bourne, Massachusetts has a high reliance on recreational fishing but there are several communities with a medium reliance in Barnstable and Nantucket Counties. Communities with high and medium high recreational fishing engagement are Nantucket, Barnstable Town, Yarmouth, Dennis, Sandwich, Bourne, Forestdale, and Westport in Massachusetts and Newport in Rhode Island. The communities with the highest recreational fishing reliance and recreational fishing engagement would be most affected by impacts on recreational fishing from offshore wind development.

Wildlife viewing is popular as well, occurring along the coast of the Elizabeth Islands and along the eastern coast of Nantucket (COP Volume 2, Section 10.3.1.2.2; SouthCoast Wind 2024).

Barnstable County (Massachusetts)

Barnstable County lies in southeastern Massachusetts and encompasses approximately 394 square miles of land (U.S. Census Bureau 2021a). The county consists of 15 historic towns and contains the Cape Cod Peninsula (COP Volume 2, Section 10.3.1.1.1; SouthCoast Wind 2024). There are 30 harbors, 40 marinas and boatyards, and about 24 private boating and yacht clubs. It has approximately 550 miles (884 kilometers) of coastline and over 150 beaches. Popular recreational activities in the area include beach going, snorkeling, windsurfing, boating, fishing, paddle sports, and diving. Canoeing, kayaking, and paddle boarding typically occur within 1 mile (1.6 kilometers) of the coastline.

Bristol County

Bristol County is in the southeastern part of Massachusetts, bordering Rhode Island, and is approximately 553 square miles (890 square kilometers) of land (U.S. Census Bureau 2021b and COP Volume 2, Section 10.3.1.1.2.1; SouthCoast Wind 2024). The county consists of 20 municipalities, including the town of Somerset (COP Volume 2, Section 10.1.1.1.4; SouthCoast Wind 2024). Popular recreational activities in the area include swimming, fishing, and wildlife viewing (COP Volume 2, Section 10.3.1.1.2.1; SouthCoast Wind 2024). People also take part in whale watching at the New Bedford Whaling National Historical Park (COP Volume 2, Section 10.3.1.2.2; SouthCoast Wind 2024).

Dukes County

Dukes County is in southeastern Massachusetts and encompasses 103 square miles of land area (U.S. Census Bureau 2021c). The county contains Martha's Vineyard, the Elizabeth Islands, and Nomans Land (COP Volume 2, Section 10.3.1.1.1; SouthCoast Wind 2024). There are many public and private beaches, harbors, marinas/boatyards, yacht clubs, and public launch facilities in the county. Due to tourists and seasonal residents, the population of Martha's Vineyard increases by a factor of ten in the summer months (COP Volume 2, Section 10.3.1.1.1; SouthCoast Wind 2024). Popular tourist destinations include the West Chop Lighthouse, located near Vineyard Haven, the East Chop Lighthouse, located in Oak Bluffs, and the Menemsha fishing village and harbor, located in Chilmark (Martha's Vineyard Chamber of Commerce 2022).

Nantucket County

Nantucket County is south of Cape Cod and encompasses approximately 44.97 square miles (72.37 square kilometers) of land (U.S. Census Bureau 2021d). It is 14 miles long and 3.5 miles wide (Town & County of Nantucket, MA 2022a). The county includes the island of Nantucket, which is an extremely popular summer tourist destination. In the summer months, the population of the Island of Nantucket increases by a factor of five due to tourists and seasonal residents (COP Volume 2, Section 10.3.1.1.1; SouthCoast Wind 2024). The county is home to many beaches, such as Brant Point Beach, which is home to the Brant Point Lighthouse. On the north end of the island, one of the most popular beaches is Jetties Beach, which has a café, restaurant, and tourist shop during the summer (Town & County of Nantucket, MA 2022b). On the south shore of the island, Surfside, Cisco, Madaket, Miacomet, and Ladies beaches are among the many beaches popular for beachgoing, onshore fishing, surfing, and other recreational activities.

Bristol County (Rhode Island)

Bristol County, located in eastern Rhode Island, is approximately 24 square miles of land (U.S. Census Bureau 2019a). The county includes the towns of Barrington, Bristol, and Warren and is connected to Newport County and Aquidneck Island by the Mount Hope Bridge (COP Volume 2, Section 10.3.1.1.2.3; SouthCoast Wind 2024). Tourists visit the county for its miles of coastlines, beaches, and boating opportunities. There are many boat ramps that support the boating community, such as Colt State Park Boat Ramp, Mount Hope Boat Ramp, and Independence Park Boat Ramp (Town of Bristol 2022).

Newport County

Newport County is located in eastern Rhode Island and encompasses about 102 square miles of land (U.S. Census Bureau 2019b). The county is made up of nine municipalities across Aquidneck Island in the southeastern region of Rhode Island and various islands in Narragansett Bay (COP Volume 2, Section 10.1.1.1.5; SouthCoast Wind 2024). It includes the City of Newport, and towns of Jamestown, Little Compton, Middletown, Portsmouth, and Tiverton. The City of Newport is located in the southwest corner of the county, and Portsmouth is located in the northeastern corner of the county. The City of Newport is especially popular among tourists for its sailing, swimming, and surfing opportunities (COP Volume 2, Section 10.3.1.1.2.2; SouthCoast Wind 2024).

Onshore Recreation

Barnstable County

Barnstable County is home to about 1,000 freshwater ponds and over 100,000 acres of habitat, wetlands, and protected open space (COP Volume 2, Section 10.3.1.1.1; SouthCoast Wind 2024). In 2017, the county's tourism industry generated $1.1 billion in direct spending and $122 in state and local taxes. The town of Falmouth has many restaurants, galleries, theaters, and concerts, as well as opportunities for hiking, camping, and bird watching. About 32 percent of the 62,705 residential units located in the county are used for seasonal, occupational, or occasional use.

Bristol County (Massachusetts)

Bristol County is home to Buttonwood Park, Freetown-Fall River National Forest, Horseneck Beach State Reservation, and New Bedford Whaling National Historic Park (COP Volume 2, Section 10.3.1.1.2.1; SouthCoast Wind 2024). Popular recreational activities include biking, hiking, and camping throughout the county. Inland marine recreational activities, such as fishing and boating, are also popular in the Taunton, Acushnet, Ten Mile, Westport, and Warren Rivers and in the North and South Watuppa ponds.

Dukes County

Dukes County contains only one federally protected area called Nomans Land Island National Wildlife Refuge (COP Volume 2, Section 10.3.1.1.1; SouthCoast Wind 2024). The county has many short-term lodgings, food and drink establishments, and other amenities. About 40 percent of Martha's Vineyard (19,968 acres [8,100 hectares]) is conserved open space (COP Volume 2, Section 10.3.1.1.1; SouthCoast Wind 2024). Areas of interest include the cultural district of Vineyard Haven, in which people can shop, dine, lodge, and attend theater and historic sites (Martha's Vineyard Chamber of Commerce 2022). Oak Bluffs is known for its shops, restaurants, carousel, and museums. Edgartown has a historic downtown with many museums, and Aquinnah is the western-most town on the island, which is home to colorful cliffs and the Aquinnah Circle Cultural District.

Nantucket County

Nantucket County is home to only one federally protected area, the Nantucket National Wildlife Refuge, which consists of 24 acres (9.7 hectares) of federally protected land, and about 50 percent of Nantucket is conserved open space (COP Volume 2, Section 10.3.1.1.1; SouthCoast Wind 2024). The county is home to over 40 miles of bike paths and walking trails and three lighthouses. Popular bike paths on the island include Cliff Road Path, Eel Point Road Path, and Surfside Road Path (Town & County of Nantucket, MA 2022c). The county hosts many food festivals throughout the year, such as the Nantucket Wine and Food Festival, as well as musical events and fairs, such as the Boston Pops at Jetties Beach and the Nantucket Island Fair (Culture & Tourism 2022). Further, Nantucket is widely known and appreciated by both residents and visitors for its historic character. The Nantucket Historic District encompasses the entire island of Nantucket (more than 27,000 acres) and contains thousands of historic resources, many of which are concentrated in Nantucket Town.

Bristol County (Rhode Island)

Bristol County encompasses Colt State Park, which has 464 acres (188 hectares) of lawns and 4 miles (6 kilometers) of paved pathways, hiking trails, historic stone walls, and shoreline. The park borders Narragansett Bay on its west side and is a popular destination for boating, biking, and wildlife viewing (Rhode Island State Parks 2022a). The county is also home to the East Bay Bike Path, which is 13.8 miles (22.2 kilometers) long and connects eight parks (Rhode Island State Parks 2022b). The Montaup Country Club is a popular and semi-private golf course in the county (COP Volume 2, Section 10.3.1.1.2.3; SouthCoast Wind 2024).

Newport County

Newport County is home to many parks with sports fields, concession stands, and historic buildings, including Aquidneck Park, Ballard Park, Brenton Point State Park, and Morton Park (City of Newport 2019). Popular tourist activities include museum and mansion tours, as well as the Cliff Walk, a 3.5-mile (5.6-kilometer) public access walk located along the eastern shore of the City of Newport (COP Volume 2, Section 10.3.1.1.2.2; SouthCoast Wind 2024). Tours of wineries and breweries are also very popular due to the large number of vineyards in the county. One of the most popular activities in Newport is the 10-mile coastal drive, which also includes bike paths (Discover Newport 2021).

3.6.8.2 Impact Level Definitions for Recreation and Tourism

Definitions of impact levels are provided in Table 3.6.8-1.

Table 3.6.8-1. Impact level definitions for recreation and tourism

Impact Level	Adverse or Beneficial	Definition
Negligible	Adverse	No impacts would occur, or impacts would be so small as to be unmeasurable.
	Beneficial	No effect or no measurable effect.
Minor	Adverse	Impacts on the affected activity or community would not disrupt the normal or routine functions of the affected activity or community.
	Beneficial	Small or measurable effects that would result in an economic improvement.
Moderate	Adverse	The affected activity or community would have to adjust somewhat to account for disruptions due to impacts of the Project.
	Beneficial	Notable and measurable effects that would result in an economic improvement.
Major	Adverse	The affected activity or community would experience substantial disruptions due to the Project.
	Beneficial	Large local or notable regional effects that would result in an economic improvement.

3.6.8.3 Impacts of Alternative A – No Action on Recreation and Tourism

When analyzing the impacts of the No Action Alternative on recreation and tourism, BOEM considered the impacts of ongoing activities, including ongoing non-offshore wind and ongoing offshore wind activities on the baseline conditions for recreation and tourism. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities, as described in Appendix D*, Planned Activities Scenario*.

Impacts of the No Action Alternative

Under the No Action Alternative, recreation and tourism in the geographic analysis area would continue to be affected by ongoing non-offshore wind activities, especially ongoing vessel traffic; noise and trenching from periodic maintenance or installation of piers, pilings, seawalls, and offshore cables; and onshore development activities. These activities would contribute to periodic disruptions to recreational and tourism activities but are a typical part of daily life along the Massachusetts and Rhode Island coastline and would not substantially affect recreational enjoyment in the geographic analysis area. Visitors would continue to pursue activities that rely on the area's coastal and ocean environment, scenic qualities, natural resources, and establishments that provide services for tourism and recreation. The geographic analysis area has a strong tourism industry and abundant coastal and offshore recreational facilities, many of which are associated with scenic views.

Ongoing offshore wind activities in the geographic analysis area that contribute to impacts on recreation and tourism include ongoing construction of the Vineyard Wind 1 project (62 WTGs and 1 OSP) in OCS-A 0501, the South Fork project (12 WTGs and 1 OSP) in OCS-A 0517, and the Revolution Wind project (65 WTGs and two OSPs) in OCS-A 0486. Ongoing construction of the Vineyard Wind 1, South Fork, and Revolution Wind projects would have the same type of impacts on recreation and tourism that are described in detail in *Cumulative Impacts of the No Action Alternative* for all ongoing and planned offshore wind activities, but the impacts would be of lower intensity.

Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative in combination with other planned non-offshore wind activities and planned offshore wind activities (without the Proposed Action).

Planned non-offshore wind activities that may affect recreation and tourism include emplacement of submarine cables and pipelines, dredging and port improvements, marine mineral use, and military use. Like ongoing activities, other planned non-offshore wind activities may result in periodic disruptions to recreation and tourism activities along the coast. However, visitors are expected to be able to continue to pursue activities that rely on other coastal and ocean environments, scenic qualities, natural resources and establishments that provide services to recreation and tourism.

The following sections summarize the potential impacts of ongoing and planned offshore wind activities in the geographic analysis area on recreation and tourism during construction, O&M, and decommissioning of the projects. Offshore wind projects other than the Proposed Action that contribute to impacts on recreation and tourism include projects within all or portions of the following lease areas: OCS-A-0486 (Revolution Wind), OCS-A-0487 (Sunrise Wind), OCS-A-0500 (Bay State Wind), OCS-A 0501

(Vineyard Wind 1), OCS-A 0517 (South Fork Wind), OCS-A-0520 (Beacon Wind), OCS-A 0522 (Vineyard Wind Northeast), and OCS-A 0534 (New England Wind) (Appendix D, Table D2-1).

Anchoring: This IPF would potentially affect recreational boating through both the presence of an increased number of anchored vessels in the geographic analysis area and the creation of offshore areas with cable hardcover or scour protection where recreational vessels may experience limitations or difficulty in anchoring.

Increased vessel anchoring during offshore wind development between 2023 and 2030 would affect recreational boaters. The greatest volume of anchored vessels would occur in offshore work areas during construction. The COP estimates there would be a maximum of 50 vessels in the Lease Area at one time (COP Volume 1, Section 3.3.14.1; SouthCoast Wind 2024). Offshore wind projects may generate similar numbers of active and anchored vessels, depending on project size and construction schedule. Anchored construction-related vessels may be within temporary safety zones established in coordination with USCG for active construction areas (COP Volume 2, Section 10.3.2.1.1; SouthCoast Wind 2024). Offshore wind development in the geographic analysis area is anticipated to result in increased survey activity and overlapping construction periods between 2023 and 2030.

Vessel anchoring would also occur during maintenance and monitoring activities during operations. Following construction of other offshore projects (if approved), the presence of operating offshore wind projects in the geographic analysis area would result in a long-term increase in the number of vessels anchored during periodic maintenance and monitoring. Vessel anchoring during maintenance and monitoring would have minor impacts on recreation and tourism.

Anchored construction, survey, or service vessels would have localized, temporary impacts on recreational boating. Recreational vessels could navigate around anchored vessels with only some brief inconvenience. The temporary turbidity from anchoring would briefly alter the behavior of species important to recreational fishing (Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*) and sightseeing (primarily whales, but also dolphins and seals) (Section 3.5.6, *Marine Mammals*). Inconvenience and navigational complexity for recreational vessels would be localized, variable, and long term, with increased frequency of anchored vessels during surveying and construction and reduced frequency of anchored vessels during operations. Construction, survey, and service vessel anchoring would have minor impacts on recreation and tourism.

Land disturbance: Other offshore wind development would require installation of onshore export cables and onshore substation infrastructure, which would cause temporary traffic delays and could temporarily affect access to adjacent properties, resulting in localized, temporary disturbances of recreational activity or tourism-based businesses near cable routes and construction sites for substations and other electrical infrastructure. These impacts would only last through construction and occasionally during maintenance events. The exact extent of impacts would depend on the locations of landfall and onshore transmission cable routes for offshore wind energy projects; however, it is anticipated these projects would generally have localized, short-term, negligible impacts during construction or maintenance and no long-term impacts on recreation and tourism use.

Lighting: Construction-related nighttime vessel lighting would be used if offshore wind development projects include nighttime, dusk, or early morning construction or material transport. In a maximum-case scenario, lights could be active throughout nighttime hours for other offshore wind projects in the geographic analysis area simultaneously under active construction (Appendix D, *Planned Activities Scenario*). Vessel lighting would enable recreational boaters to safely avoid nighttime construction areas. The impact on recreational boaters would be localized, sporadic, short term, and minimized by the limited offshore recreational activities that occur at night.

In the geographic analysis area, permanent aviation warning lighting required on the WTGs would be visible from beaches and coastlines of Martha's Vineyard and Nantucket and could have impacts on recreation and tourism in certain locations if the lighting influences visitor decisions in selecting coastal locations to visit. FAA hazard lighting systems would be in use for the duration of O&M for up to 901 WTGs. The amassing of these WTGs and associated synchronized flashing strobe lights affixed with a minimum of three red flashing lights at the mid-section of each tower and one at the top of each WTG nacelle in the offshore wind lease areas would have long-term impacts on sensitive onshore and offshore viewing locations, based on viewer distance and angle of view and assuming no obstructions. Atmospheric and environmental factors, such as haze and fog would influence visibility and perception of hazard lighting from sensitive viewing locations (Section 3.6.9, *Scenic and Visual Resources*).

A University of Delaware study evaluating the impacts of visible offshore WTGs on beach use found that WTGs visible more than 15 miles (24 kilometers) from the viewer would have negligible impacts on businesses dependent on recreation and tourism activity (Parsons and Firestone 2018). The study participants viewed visual simulations of WTGs in clear, hazy, and nighttime conditions (without ADLS). A 2017 visual preference study conducted by North Carolina State University evaluated the impact of offshore wind facilities on vacation rental prices. The study found that nighttime views of aviation hazard lighting (without ADLS) for WTGs close to shore (5 to 8 miles [8 to 13 kilometers]) would adversely affect the rental price of properties with ocean views (Lutzeyer et al. 2017). It did not specifically address the relationship between lighting, nighttime views, and tourism for WTGs 15 or more miles (24.1 or more kilometers) from shore. Most WTG positions likely to be present based on anticipated offshore wind lease area build-out in the geographic analysis area would be more than 15 miles (24.1 kilometers) from coastal locations with views of the WTGs.

In addition to recreational fishing, some recreational boating in the region involves whale watching and other wildlife-viewing activity. A 2013 BOEM study evaluated the impacts of WTG lighting on birds, bats, marine mammals, sea turtles, and fish. The study found that existing guidelines "appear to provide for the marking and lighting of [WTGs] that will pose minimal if any impacts on birds, bats, marine mammals, sea turtles or fish" (Orr et al. 2013). By extension, existing lighting guidelines or ADLS (if implemented) would impose a minimal impact on recreational fishing or wildlife viewing.

As a result, although lighting on WTGs would have a continuous, long-term, minor adverse impact on recreation and tourism, the impact in the geographic analysis area is likely to be limited to individual decisions by visitors to the shorefronts of Martha's Vineyard and Nantucket and elevated areas, with less impact on the recreation and tourism industry as a whole.

The implementation of ADLS would activate the hazard lighting system in response to detection of nearby aircraft. The synchronized flashing of the navigational lights, if ADLS is implemented, would result in shorter-duration night sky impacts on the seascape, landscape, and viewers. The shorter-duration synchronized flashing of the ADLS is anticipated to have reduced visual impacts at night as compared to the standard continuous, medium-intensity red strobe FAA warning system due to the duration of activation. ADLS controlled obstruction lights would be activated in the Lease Area for less than 5 hours per year (COP Appendix T, Section 5.1.3; SouthCoast Wind 2024). It is anticipated that the reduced time of FAA hazard lighting resulting from an implemented ADLS would reduce the duration of potential impacts of nighttime aviation lighting to less than 1 percent of the normal operating time that would occur without using ADLS.

Cable emplacement and maintenance: Other offshore wind export cables in the geographic analysis area could total 1,738 miles (2,797 kilometers), while interarray cables could total 1,782 miles (2,868 kilometers) (excluding the Proposed Action). Cables for other offshore wind projects would likely be emplaced in the geographic analysis area between 2023 and 2030. Offshore cable emplacement for offshore wind development projects would have temporary, localized, adverse impacts on recreational boating while cables are being installed, because vessels would need to navigate around work areas, and recreational boaters would likely prefer to avoid the noise and disruption caused by installation. Cable installation could also have temporary impacts on fish and invertebrates of interest for recreational fishing, due to the required dredging, turbulence, and disturbance; however, species would recover upon completion (Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*). The degree of temporal and geographic overlap of each cable is unknown, although cables for some projects could be installed simultaneously. Active work and restricted areas would only occur over the cable segment being emplaced at a given time. Once installed, cables would affect recreational boating only during maintenance operations, except that the mattresses covering cables in hard-bottom areas could hinder anchoring and result in gear entanglement or loss.

Impacts of cable emplacement and maintenance on recreational boating and tourism would be short term, continuous, adverse, and localized. Disruptions from cable emplacement and maintenance are anticipated to have a minor impact on recreation and tourism.

Noise: Noise from construction, pile driving, HRG survey activities, trenching, O&M, and vessels could result in minor adverse impacts on recreation and tourism.

Onshore construction noise from cable installation at the landfall sites, and inland if cable routes are near parkland, recreation areas, or other areas of public interest, would temporarily disturb the quiet enjoyment of the site (in locations where such quiet is an expected or typical condition). Similarly, offshore noise from HRG survey activities, pile driving, trenching, and construction-related vessels would intrude upon the natural sounds of the marine environment. This noise could cause some boaters to avoid areas of noise-generating activity, although some of the most intense noise could be within safety zones that USCG may establish within 12 nm of the coast for areas of active construction, which would be off-limits to boaters. BOEM conducted a qualitative analysis of impacts on recreational fisheries for the construction phases of offshore wind development in the Atlantic OCS region. Results showed the construction phase is expected to have a slightly negative to neutral impact on recreational fisheries due to both direct exclusion of fishing activities and displacement of mobile target species by the construction noise (Kirkpatrick et al. 2017). The impact of noise on recreation and tourism during construction would be adverse, intense, and disruptive, but short term and localized.

Adverse impacts of noise on recreation and tourism would also result from the adverse impacts on species important to recreational fishing and sightseeing in the geographic analysis area and along cable routes. Because most recreational fishing takes place closer to shore, only a small proportion of recreational fishing would be affected by construction noise of WTGs. Recreational fishing for highly migratory species, such as tuna, shark, and marlin, is more likely to be affected, as the highly migratory species fishery usually occurs farther offshore than most recreational fisheries and, therefore, is more likely to experience temporary impacts resulting from the noise generated by offshore wind construction. Construction noise could contribute to temporary impacts on marine mammals, with resulting impacts on marine sightseeing that relies on the presence of mammals, primarily whales. However, as noted in Section 3.5.6, *Marine Mammals*, other projects are expected to comply with mitigation measures (e.g., exclusion zones, protected species observers) that would avoid and minimize underwater noise impacts on marine mammals.

Offshore wind surveying and construction would occur in the geographic analysis area between 2023 and 2030. Based on the discussion above, offshore wind construction would result in short-term, localized, adverse impacts on recreational fishing and marine sightseeing related to fish and marine mammal populations. Multiple construction projects would increase the spatial and temporal extent of temporary disturbance to marine species in the geographic analysis area. As indicated in Appendix D, *Planned Activities Scenario*, up to 901 offshore WTGs could be installed between 2023 and 2030 in the geographic analysis area, not including the Proposed Action. No long-term, adverse impacts are anticipated that would result in population-level harm to fish and marine mammal populations.

During operations, the continuous noise generated by WTG operation would occur at least 12 miles (32 kilometers) from any onshore noise-sensitive locations and is not expected to produce sound in excess of background levels at any onshore locations. Noise from operational WTGs would be expected to have little effect on finfish, invertebrates, and marine mammals and, therefore, little effect on recreational fishing or sightseeing. The impact of noise during O&M would be negligible, localized, continuous, and long term, with brief, more-intensive noise during occasional repair activities.

Port utilization: Ports in the geographic analysis area for recreation and tourism that could be used for construction and O&M of offshore wind development include ports off the coast of Massachusetts, Rhode Island, Connecticut, and Virginia (COP Volume 1, Section 3.3.13; SouthCoast Wind 2024). These ports may also provide facilities for recreational vessels or may be on waterways shared with recreational marinas, and may experience increased activity, expansion, or dredging. Regional ports suitable for staging and construction of other offshore wind development are primarily industrial in character, with recreational activity as a secondary use.

Port improvements could result in negligible impacts as a result of short-term delays and crowding during construction but could provide long-term benefits to recreational boating if the improvements result in increased berths and amenities for recreational vessels or improved navigational channels.

Presence of structures: The placement of 901 WTGs (excluding the Proposed Action) in the geographic analysis area would contribute to impacts on recreational fishing and boating. The offshore structures would have long-term, adverse impacts on recreational boating and fishing through the risk of allision; risk of gear entanglement, damage, or loss; navigational hazards; space use conflicts; presence of cable infrastructure; and visual impacts (additional information provided in Section 3.6.1, *Commercial Fisheries and For-Hire Recreational Fishing*). However, offshore wind structures could have beneficial impacts on recreation through fish aggregation and reef effects. The WTGs installed for offshore wind development (excluding the Proposed Action) are expected to serve as additional artificial reef structures, providing additional locations for recreational for-hire fishing trips, potentially increasing the number of trips and revenue. The increased number of fishing trips out of nearby ports could also support increased angler expenditures at local bait shops, gas stations, and other shore-side dependents.

Offshore wind development could require adjustment of routes for recreational boaters, anglers, sailboat races, and sightseeing boats, but the adverse impact of the offshore wind structures on recreational boating would be limited by the distance offshore. Most recreational boating takes place within 3 nm (5.5 kilometers) of the shore and within state waters (COP Volume 2, Section 10.3.1.2.1; SouthCoast Wind 2024). Boating routes with the highest density in Nantucket Sound were located in the channel between Falmouth and Martha’s Vineyard and north of the Nantucket Boat Basin. In addition, sailing in the geographic analysis area primarily occurs in relatively small areas in the bays and inlets and just along the coastline. Private recreational anglers may avoid fishing near WTG structures due to concerns about their ability to safely fish in or navigate through the area. Kirkpatrick et al. (2017) analyzed recreational fishing exposure from offshore wind development by quantifying the total recreational fishing activity that may be affected by offshore wind development in a given area if anglers opt to no longer fish in this area and cannot go to a different location. For the Massachusetts WEA, recreational fishing was considered “exposed” to potential impact if at least part of the trip occurred within 1 nm (1.9 kilometers) of the Massachusetts WEA during the study period (2007–2012). During the study period, angler trips from Fall River and New Bedford, Massachusetts, would be most exposed to the Massachusetts WEA. From Fall River, about 4,133 private angler trips, or 10.0 percent of total angler trips, would be exposed. From New Bedford, about 4,067 private angler trips, or 9.6 percent of total angler trips, would be exposed (Kirkpatrick et al. 2017). See Section 3.6.1, *Commercial Fisheries and For-Hire Recreational Fishing,* for more discussion on for-hire fishing.

WTG foundations, associated scour protection, and cable protection for export and interarray cables would result in an increased risk of entanglement. The cable protection would also present a hazard for anchoring, because anchors could have difficulty holding or become snagged and lost. Accurate marine charts could make operators of recreational vessels aware of the locations of the cable protection and scour protection. If the hazards are not noted on charts, operators may lose anchors, leading to increased risks associated with drifting vessels that are not securely anchored.

Offshore WTGs could provide new opportunities for offshore tourism by attracting recreational fishing and sightseeing. The structures could produce artificial reef effects. The "reef effect" refers to the introduction of a new hard-bottom habitat that has been shown to attract numerous species of algae, shellfish, finfish, and sea turtles to new benthic habitat (COP Volume 2, Section 6.7.4.3, Table 6-56; SouthCoast Wind 2024). The reef effect could attract species of interest for recreational fishing and result in an increase in recreational boaters traveling farther from shore to fish in the geographic analysis area.

As it relates to the visual impacts of structures, the vertical presence of WTGs on the offshore horizon may affect recreational experience and tourism in the geographic analysis area. Section 3.6.9, *Scenic and Visual Resources*, describes the visual impacts from offshore wind infrastructure. Studies and surveys that have evaluated the impacts of offshore wind facilities on tourism found that established offshore wind facilities in Europe did not result in decreased tourist numbers, tourist experience, or tourist revenue, and that Block Island Wind Farm's WTGs provide excellent sites for fishing and shellfishing (Smythe et al. 2018). A survey-based study found that, for prospective offshore wind facilities (based on visual simulations), proximity of WTGs to shore is correlated to the share of respondents who would expect a worsened experience visiting the coast (Parsons and Firestone 2018).

- At 15 miles (24.1 kilometers), the percentage of respondents who reported that their beach experience would be worsened by the visibility of WTGs was about the same as the percentage of those who reported that their experience would be improved (e.g., by knowledge of the benefits of offshore wind).
- About 68 percent of respondents indicated that the visibility of WTGs would neither improve nor worsen their experience.
- Reported trip loss (respondents who stated that they would visit a different beach without offshore wind development) averaged 8 percent when wind projects were 12.5 miles (20 kilometers) offshore, 6 percent when 15 miles (24.1 kilometers) offshore, and 5 percent when 20 miles (32 kilometers) offshore.
- About 2.6 percent of respondents were more likely to visit a beach with visible offshore wind facilities at any distance.

A 2019 survey of 553 coastal recreation users in New Hampshire included participants in water-based recreational activities, such as fishing from shore and boats, motorized and non-motorized boating, beach activities, and surfing at the New Hampshire seacoast. Most (77 percent) supported offshore wind development along the New Hampshire coast, while 12 percent opposed it and 11 percent were neutral. Regarding the impact on their outdoor recreation experience, 43 percent anticipated that offshore wind development would have a beneficial impact, 31 percent anticipated a neutral impact, and 26 percent anticipated an adverse impact (BOEM 2021).

The wind turbines considered in the studies cited above anticipated smaller WTGs than are proposed for the planned offshore wind projects in the region, including the Proposed Action. The 2018 Parsons and Firestone study was based on turbines with blade tips of 574 feet (175 meters) at distances of 2.5 to 20 miles (4 to 32 kilometers) offshore. In comparison, the Proposed Action's WTGs would have a blade tip height of up to 1,066.3 feet (325.0 meters) but would be located 23 miles (37 kilometers) from shore at the closest point. Both the WTGs examined in the studies and the WTGs considered as part of planned offshore wind projects would have WTG hubs, nacelles, navigation lights, and rotor blades visible to viewers on the nearest beaches. The visibility of the WTGs would be variable, depending on meteorological, moonlight, and sunlight conditions. In views seaward, there would be periods of high, moderate, low and no visibility. Therefore, both the 2018 Parsons and Firestone study and this EIS conclude that the WTGs' hubs, nacelles, navigation lights, and rotor blades would be visible to viewers on the nearest beaches. The taller WTGs associated with planned offshore wind projects would result in increased numbers of WTGs visible, but they would be at greater distances compared to the cited studies; therefore, the results of the studies are still relevant to this analysis.

Portions of the WTGs in the geographic analysis area associated with other offshore wind projects could be visible from shorelines (depending on vegetation, topography, weather, atmospheric conditions, and the viewers' visual acuity). WTGs visible from some shoreline locations in the geographic analysis area would have adverse impacts on visual resources when discernable due to the introduction of industrial elements in previously undeveloped views. A 2020 survey-based preference study to determine attitude toward offshore wind and if the presence of offshore wind turbines affects the number of trips a beachgoer makes to the beach found that developed beaches with boardwalks and beaches that were designated as local, state, or national parks had the lowest amount of reported trip cancellations (Parsons et al. 2020). The beachgoers at local, state, or national park beaches self-reported as more favorable toward wind power and correspondingly appeared less inclined to cancel a trip due to the presence of wind turbines. Refer also to Section 3.6.3, *Demographics, Employment, and Economics*, for additional discussion of the economic impacts on recreation and tourism from the visual presence of WTGs and OSPs.

Based on the relationship between visual impacts and impacts on recreational experience, the impact of visible WTGs on recreation would be moderate, long term, continuous, and adverse. Seaside locations could experience some reduced recreational and tourism activity, but the visible presence of WTGs would be unlikely to affect shore-based or marine recreation and tourism in the geographic analysis area as a whole.

Traffic: Other offshore wind project construction and decommissioning and, to a lesser extent, offshore wind project operation would generate increased vessel traffic that could inconvenience recreational vessel traffic in the geographic analysis area. The impacts would occur primarily during construction, along routes between ports and the offshore wind construction areas. Vessel traffic for each project is not known but is anticipated to be similar to that of the Proposed Action, which is projected to generate between 15 and 35 vessels operating in the Wind Farm Area or over the offshore export cable route at any given time (COP Volume 1, Section 3.3.14.1; SouthCoast Wind 2024). Between 2023 and 2030 as many as 12 offshore wind projects (not including the Proposed Action) could be under construction. During periods of overlapping construction and assuming similar vessel counts as under the Proposed Action, construction of offshore wind projects would generate up to 420 vessels (either underway or at anchor) at any given time in the geographic analysis area.

Increased vessel traffic would require increased alertness on the part of recreational or tourist-related vessels and would result in minor delays or route adjustments. The likelihood of vessel collisions would increase as a result of the higher volumes of vessel traffic during construction. The possibility of delays and risk of collisions would increase if more than one offshore wind facility is under construction at the same time. Vessel traffic associated with offshore wind would have long-term, variable, minor adverse impacts on vessel traffic related to recreation and tourism. Higher volumes during construction would result in greater inconvenience, disruption of the natural marine environment, and risk of collision. Vessel traffic during operations would represent only a modest increase in the background volumes of vessel traffic, with minimal impacts on recreational vessels.

Conclusions

Impacts of the No Action Alternative: BOEM expects ongoing non-offshore wind activities and offshore wind activities to have continuing impacts on recreation and tourism. The impacts of ongoing activities, including ongoing construction of the Vineyard Wind 1 and South Fork projects, ongoing vessel traffic, presence of structures, and the noise and trenching from periodic maintenance or installation of piers, pilings, seawalls, or offshore cables, would be **minor**.

Cumulative Impacts of the No Action Alternative: BOEM anticipates that planned activities would have a noticeable incremental effect on the cumulative impacts of the No Action Alternative, which would be **moderate** adverse and **minor beneficial**. Planned offshore wind activities are expected to contribute considerably to several IPFs, the most prominent being noise and vessel traffic during construction and the presence of offshore structures during operations. Noise and vessel traffic would have impacts on visitors, who may avoid onshore and offshore noise sources and vessels, and on recreational fishing and sightseeing as a result of the impacts on fish, invertebrates, and marine mammals. BOEM also anticipates that the offshore wind activities in the geographic analysis area would result in minor beneficial impacts due to the presence of offshore structures and cable hardcover, which could provide opportunities for fishing and sightseeing. Planned non-offshore activities including emplacement of submarine cables and pipelines, dredging and port improvements, marine mineral use, and military use would also contribute to impacts, but any disruptions to recreational activity would be temporary and minimal.

3.6.8.4 Relevant Design Parameters and Potential Variances in Impacts

This EIS analyzes the maximum-case scenario; any potential variances in the proposed Project build-out as defined in the PDE would result in impacts similar to or less than described in the following sections. The following proposed PDE parameters (Appendix C, *Project Design Envelope and Maximum-Case Scenario*) would influence the magnitude of the impacts on recreation and tourism.

- The Project layout including the number, type, height, and placement of the WTGs and OSPs, and the design and visibility of lighting on the structures.
- Arrangement of WTGs and accessibility of the Wind Farm Area to recreational boaters.
- The time of year during which onshore and nearshore construction occurs.

Variability of the proposed Project design exists as outlined in Appendix C. Below is a summary of potential variances in impacts.

- WTG number, size, location, and lighting: More WTGs and larger turbine sizes closer to shore could increase visual impacts that affect onshore recreation and tourism, as well as recreational boaters. Arrangement and type of lighting systems would affect nighttime visibility of WTGs onshore.
- WTG arrangement and orientation: Different arrangements of WTG arrays may affect navigational patterns and safety of recreational boaters.
- Time of construction: Tourism and recreational activities in the geographic analysis area tend to be higher from May through September, and especially from June through August (Parsons and Firestone 2018). Impacts on recreation and tourism would be greater if Project construction were to occur during this season.

SouthCoast Wind has committed to measures to minimize impacts on recreation and tourism, which include, but are not limited to, developing, and implementing a Traffic Management Plan to minimize disruptions to residences and commercial establishments in the vicinity of onshore construction activities and development of an onshore construction schedule to minimize effects on recreational uses and tourism-related activities to the extent feasible (COP Volume 2, Table 16-1; SouthCoast Wind 2024).

3.6.8.5 Impacts of Alternative B – Proposed Action on Recreation and Tourism

The Proposed Action would have long-term, minor impacts on recreation and tourism in the geographic analysis area due to the visual impact of the 147 WTGs from coastal locations and the greater navigational risks for recreational vessels in the Wind Farm Area. It would also have long-term, minor beneficial impacts due to the fish aggregation and habitat conversion impacts of the WTGs and OSPs, resulting in new fishing and sightseeing opportunities. The Proposed Action would have short-term, minor impacts during construction due to the temporary impacts of noise and vessel traffic on recreational vessel traffic, the natural environment, and species important for recreational fishing and sightseeing.

Anchoring: Anchoring by Proposed Action construction, O&M, and decommissioning vessels would contribute to disturbance of marine species and inconvenience to recreational vessels that must navigate around the anchored vessels. Construction of the Proposed Action would generate between 15 and 35 vessels operating in the Wind Farm Area or over the offshore export cable route at any given time (COP Volume 1, Section 3.3.14.1; SouthCoast Wind 2024). SouthCoast Wind has proposed implementing safety zones around offshore construction areas in consultation with the USCG, which would minimize the potential for recreational boater interaction with anchored construction vessels in these areas (COP Volume 2, Section 10.3.2.1.1; SouthCoast Wind 2024). Vessel anchoring for construction of the Proposed Action would have localized, short-term, minor impacts on tourism and recreation due to the need to navigate around vessels and work areas and the disturbance of species important to recreational fishing.

Land disturbance: Onshore construction would affect recreation and tourism where construction activity interferes with access to recreation sites or increases traffic, noise, or temporary emissions that degrade the recreational experience. Ground disturbance from installation of the cables would be localized to the immediate vicinity of construction (COP Volume 1, Section 3.4.1.4.1; SouthCoast Wind 2024). Several of the proposed landfall sites for both export cable corridors would occur within or adjacent to recreational areas. For the Falmouth onshore export cable, these areas include a landfall in Worcester Park near Falmouth Heights Beach, within Central Park at Falmouth Heights Beach, and at a public parking area at Surf Drive Beach. For the Brayton Point onshore export cable, these areas include the entry landfall near Island Park Beach, HDD-installed cables underneath Bertha K. Russel Preserve, and an exit landfall within a parking lot at the Montaup Country Club at the intermediate landfall on Aquidneck Island. During HDD activity at these landfalls, recreational users of these and nearby sites would experience temporary disruptions including elevated noise, emissions, and visual disturbances that may decrease recreational enjoyment. Sites may need to be fully or partially closed while construction activity is taking place, further restricting the recreational use of these areas. Because the HDD landfall sites are proposed inland, no impacts on beach access or recreational fishing is expected, with the exception of the Falmouth landfall in the public parking area at Surf Drive Beach where use of the parking lot may be restricted during construction. Based on NOAA's Marine Recreational Information Program (NOAA 2022c), no public fishing sites are in the immediate vicinity to these landfall sites that would be affected by HDD or other cable installation activities.

Following construction, these sites would be returned to their previous condition, with the exception of a transition joint/vault that can be accessed for maintenance, and recreational use would be restored. From the point of landfall, cables would be installed in trenches within existing roadways where feasible (COP Volume 1, 3.3.7.1; SouthCoast Wind 2024). Because the onshore cable routes would mostly follow existing road rights-of-way, there would be no direct impacts on recreational sites or activities, although there may be some temporary indirect impacts due to temporary lane closures, detours, and vehicle congestion. Overall, installation of the landfall locations and onshore cable routes would result in localized, short-term, and minor impacts on recreation and tourism. The proposed onshore substations, if Falmouth is selected as the POI for Project 2, and converter stations would be located on gravel quarry sites and a former power plant where no recreational activity occurs. Therefore, impacts from onshore construction of these facilities would be localized, temporary, and negligible.

As discussed in Section 3.6.3, *Demographics, Employment, and Economics*, the employment and economic impact would be localized, short term, and minor. As discussed in Section 3.6.5, *Land Use and Coastal Infrastructure*, technologies may be used to minimize impacts on land disturbance. SouthCoast Wind has committed to implementing a construction schedule to minimize activities in the onshore export cable route during the peak summer recreation and tourism season and to coordinate with local municipalities to minimize impacts on popular events in the area during construction, to the extent practicable (COP Volume 2, Section 16, Table 16-1; SouthCoast Wind 2024). These measures would minimize impacts on recreation and tourism from construction activities.

Lighting: When nighttime construction occurs, the vessel lighting for vessels traveling to and working at the Proposed Action's offshore construction areas may be visible from onshore locations depending upon the distance from shore, vessel height, and atmospheric conditions. Visibility would be sporadic and variable. Although most construction is expected to occur during daylight hours, construction vessels would use work lights to improve visibility during night or poor visibility, in accordance with USCG requirements.

During operations, the Proposed Action would have a discrete contribution to nighttime visibility of the WTGs due to required aviation hazard lighting. SouthCoast Wind has committed to voluntarily implementing ADLS, which would activate the Proposed Action's WTG lighting only when aircraft approach the WTGs (COP Volume 2, Section 8.2.2.2; SouthCoast Wind 2024). The implementation of ADLS would reduce the duration of the potential impacts of nighttime aviation lighting to less than 1 percent of the normal operating time that would occur without using ADLS (COP Appendix T, Section 5.1.3; SouthCoast Wind 2024). During times when the Proposed Action's aviation warning lighting is visible, this lighting would add a developed/industrial visual element to views that were previously characterized by dark, open ocean. Due to the limited duration and frequency of such events and the distance of the Proposed Action's WTGs from shore, visible aviation hazard lighting for the Proposed Action would result in a long-term, intermittent, negligible impact on recreation and tourism. For the onshore substations, SouthCoast Wind will work with Falmouth and Somerset, Massachusetts to ensure the lighting scheme for the onshore substation and/or converter stations complies with Town requirements. Operational lighting would be down-shielded to mitigate light pollution and will be designed to comply with nigh sky lighting standards (COP Volume 2, Section 8.2.2.2; SouthCoast Wind 2024).

Cable emplacement and maintenance: The Proposed Action's cable emplacement would generate vessel anchoring and dredging at the worksite, requiring recreational vessels to avoid and navigate around the worksites and resulting in short-term disturbance to species important to recreation and tourism. The Proposed Action would require export cables that would be 1,179 statute miles (1,897 kilometers) long and interarray cables that would be 497 statute miles (800 kilometers) long (Appendix D, Table D2-1). Cable installation would require a maximum of eight vessels (three cable lay barges and five cable transport and lay vessels) (COP Volume 1, Section 3.3.14.1, Table 3-21; SouthCoast Wind 2024). Recreational vessels traveling near the offshore export cable routes would need to navigate around vessels and access-restricted areas associated with the offshore export cable installation. The proposed Falmouth and Brayton Point offshore export cable routes intersect and pass adjacent to several popular offshore fishing areas, including the Owl and Mutton Shoal (COP Volume 2, Figure 11-22, SouthCoast Wind 2024). SouthCoast Wind has committed to developing a communication plan to inform recreational fishers, among others, of construction and maintenance activities and vessel movements, which would minimize potential adverse impacts associated with cable emplacement and maintenance activity (COP Volume 2, Section 10.3.2.2.2; SouthCoast Wind 2024). The localized, temporary need for changes in navigation routes due to Proposed Action construction would constitute a minor impact.

Cable installation could also affect fish and marine mammals of interest for recreational fishing and sightseeing through dredging and turbulence, although species would recover upon completion (Section 3.5.6, *Marine Mammals*, and Section 3.5.7, *Sea Turtles*), resulting in localized, short-term, minor impacts on recreation and tourism. Cable emplacement and maintenance that occur near beaches, fishing sites, or nearshore recreational activities could contribute to recreational impacts due to temporary water quality impacts during construction and maintenance.

Noise: Noise from onshore cable installation, O&M, pile driving and trenching, and vessels could result in impacts on recreation and tourism. Temporary impacts on recreation and tourism would result from impacts in the Wind Farm Area and along the offshore export cable route on species important to recreational fishing and marine sightseeing. The temporary disruptions to or changes in offshore fish, shellfish, and whale populations (Sections 3.5.5 and 3.5.6) would have a minor impact on recreational fishing or marine sightseeing.

In addition to the temporary disruption to fish and shellfish, noise generated by offshore construction and onshore cable installation would have impacts on the recreational enjoyment of the marine and coastal environments, with minor impacts on recreation and tourism. Offshore construction noise would occur from vessels, pile driving, and other installation activities along the offshore export cable route and in the Wind Farm Area. As the Proposed Action would be built 20 nm (48 kilometers) offshore, noise effects from offshore construction noise on onshore recreational activities would be temporary and negligible. Recreational boaters in the vicinity of the WTG and offshore cable installation may experience increased noise from construction, which would temporarily inconvenience recreational boaters.

SouthCoast Wind conducted noise modeling for onshore construction activities (e.g., HDD) and onshore substation and converter stations operations to assess the impact on sensitive receptors and conformance with acoustic regulatory thresholds (COP Volume 2, Section 9; SouthCoast Wind 2024). The analysis determined that noise from construction and operations would comply with applicable thresholds assuming implementation of applicant-proposed measures, such as installing sound barriers (refer to COP Volume 2, Section 9.1.5 for a description of the proposed measures [SouthCoast Wind 2024]). While temporary noise increases could affect the enjoyment of some recreators in the vicinity of construction activity, the effects would be localized, short-term and minor. Because the proposed onshore substations and converter stations would be located on sand and gravel quarries and a former power plant where no recreational use occurs, and SouthCoast Wind would implement applicant-proposed measures to minimize noise levels, the effects of operational noise on recreation would be long-term but negligible.

Overall, construction noise from the Proposed Action alone would have localized, short-term, minor impacts on recreation and tourism. Offshore operational noise from the WTGs would be similar to the noise described for other projects under the No Action Alternative and would, therefore, have continuous, long-term, negligible impacts.

Port utilization: In the geographic analysis area, the Proposed Action would use facilities primarily off the coast of Massachusetts and Rhode Island for construction and O&M (COP Volume 1, Section 3.3.13; SouthCoast Wind 2024). No port upgrades are proposed as part of the Proposed Action upgrades. Vessel traffic in the port areas may result in short-term delays and crowding during construction, which could temporarily affect recreational vessel use. The Proposed Action would have a short-term, negligible impact on recreation and tourism due to port utilization in the geographic analysis area.

Presence of structures: The Proposed Action's 149 WTGs and five OSPs would affect recreation and tourism through increased navigational complexity; attraction of recreational vessels to offshore wind structures for fishing and sightseeing; the adjustment of vessel routes for recreational fishing; the risk of fishing gear loss or damage by entanglement due to scour or cable protection; difficulties in anchoring over scour or cable protection; and visual impacts.

Construction and installation, expected to begin in 2025, would affect recreational boaters. Risk of allision with anchored vessels would increase incrementally during construction, as more anchored vessels would be in the recreation and tourism geographic analysis area. SouthCoast Wind has committed to developing a communication plan to inform the public of construction and maintenance activities and vessel movements, which would minimize potential adverse impacts associated with structure construction activities (COP Volume 2, Section 10.3.2.2.2; SouthCoast Wind 2024). Most recreational boating takes place within 3 nm (5.5 kilometers) of the shore and within state waters (COP Volume 2, Section 10.3.1.2.1; SouthCoast Wind 2024). Boating routes with the highest density in vicinity of Nantucket Sound were located in the channel between Falmouth and Martha's Vineyard and north of the Nantucket Boat Basin. Given the Lease Area's relative distance from shore and marina facilities, recreational boating activity in the Lease Area is less intense than in areas closer to the coast. SouthCoast Wind proposes to minimize impacts through the navigation-related AMMs listed in the COP Volume 2 Table 16-1.

During O&M of the Proposed Action, the permanent presence of WTGs would create obstacles for recreational vessels. At their lowest point, WTG blade tips would be 75.5 feet (23 meters) above the highest astronomical tide (COP Volume 1, Section 3.3.2; SouthCoast Wind 2024). At this height, larger sailboats would need to navigate around the Wind Farm Area, while smaller vessels could navigate unobstructed (except for the WTG monopiles).

There are several popular offshore fishing areas in the geographic analysis area as shown in the COP Volume 2 Figure 11-22, but none of these areas overlap the Lease Area (SouthCoast Wind 2024). As noted in Section 3.6.1, *Commercial Fisheries and For Hire Recreational Fishing*, navigational hazards and scour/cable protection due to the presence of structures from ongoing and planned activities, including the Proposed Action, would result in substantial adverse impacts on commercial fisheries and for-hire recreational fishing. Some beneficial impacts on recreational fishing due to the artificial reef effect are expected. Evidence from Block Island Wind Farm indicates an increase in recreational fishing near the WTGs (Smythe et al. 2018). However, the magnitude of benefits to recreational fishermen resulting from the Project may be reduced due to the greater distance of these structures from the shore (Starbuck and Lipsky 2013). As noted, surveys of recreational boaters along the northeastern United States coast found that the highest density of recreational vessels occurs within 1 nm of the coastline (Starbuck and Lipsky 2013). BOEM does not anticipate that habitat conversion and fish aggregation due to the presence of structures would result in considerable changes in fish distributions across the geographic analysis area. Overall, the impacts on recreational fishing, boating, and sailing generally would be negligible, while the impacts on for-hire fishing would be minor because these enterprises are more likely to be materially affected by displacement.

As it relates to visual impacts of presence of structures, the Proposed Action's WTGs would also affect recreation and tourism through visual impacts. During construction, viewers on Martha's Vineyard and Nantucket would see the upper portions of tall equipment, such as mobile cranes. These cranes would move from turbine to turbine as construction progresses and, thus, would not be long-term fixtures. Based on the duration of construction activity, visual contrast associated with construction of the Proposed Action would have a temporary, negligible impact on recreation and tourism.

The WTGs would be in open ocean approximately 20 nm (37 kilometers) east from the coast. The maximum-case WTGs would have a hub height of 605.1 feet (184.4 meters) above mean lower low water (COP Volume 1, Section 3.3, Table 3-1; SouthCoast Wind 2024), a navigation light at the top of the nacelle, and a mid-tower light. At maximum vertical extension, the blade tips of the WTGs (1,066.3 feet or 325.0 meters) would be theoretically visible to a viewer at a 5-foot (1.5-meter) eye level above the ocean surface or beach shoreline elevation at distances up to 42.8 miles (68.9 kilometers) on clear-day conditions. Between 33.6 (54.1 kilometers) and 42.8 miles (68.9 kilometers), only the WTG blades would be potentially visible above the horizon from the perspective of a beach-elevation viewer. The blades, navigation light, nacelle, hub, tower, and mid-tower light would be theoretically visible to viewers on the ocean surface or beach shoreline at distances between 24.2 (38.9 kilometers) and 42.8 miles (68.9 kilometers). SouthCoast Wind has voluntarily committed to use ADLS and non-reflective pure white (RAL Number 9010) or light gray (RAL Number 7035) paint colors to reduce impacts (COP Appendix T, Section 5.4; SouthCoast Wind 2024). Section 3.6.9, *Scenic and Visual Resources,* describes the visual impacts from offshore wind infrastructure.

The visual impact of future offshore wind structures could affect recreation and tourism, including on Martha's Vineyard and Nantucket where the WTGs are visible. The visual contrast created by the WTGs could have a beneficial, adverse, or neutral impact on the quality of the recreation and tourism experience depending on the viewer's orientation, activity, and purpose for visiting the area. For example, on Nantucket, the view of WTGs from the Nantucket Historic District may affect heritage tourists, for which the historic character of the area is an important feature (refer to Section 3.6.2, *Cultural Resources*, for a discussion of the effects on the Nantucket Historic District and BOEM's consultation under Section 106 of the NHPA to mitigate effects). Studies and surveys that have evaluated the impacts of offshore wind facilities on tourism have identified variable reactions to offshore wind, with respondents having positive, neutral, or negative views of the effect that offshore wind infrastructure would have on their experience of coastal recreation (Parsons and Firestone 2018; BOEM 2021), while a study in Europe found that established offshore wind facilities did not result in decreased tourist numbers, tourist experience, or tourist revenue (Smythe et al. 2018). Beaches with views of WTGs could gain trips from the estimated 2.5 percent of beach visitors for whom viewing the WTGs would be a positive result, offsetting some lost trips from visitors who consider views of WTGs to be negative and the 8 percent of respondents who stated they would visit a different beach without offshore wind development (Parsons and Firestone 2018). Additional research on the link between visual impacts of future offshore wind, and resultant impacts on recreation and tourism, is summarized in Section 3.6.8.3, *Impacts of Alternative A – No Action on Recreation and Tourism*. Refer also to Section 3.6.3, *Demographics, Employment, and Economics*, for a discussion of the economic impacts on tourism and recreation from the visible presence of the Proposed Action's WTGs and OSPs. BOEM expects the impact of visible WTGs on the use and enjoyment of recreation and tourist facilities and activities during O&M of the Proposed Action to be long term, continuous, and minor.

Traffic: The Proposed Action would contribute to increased vessel traffic and associated vessel collision risk, primarily during Project construction and decommissioning, along routes between ports and the offshore construction areas. Construction of the Proposed Action would generate between 15 and 35 vessels operating in the Wind Farm Area or over the offshore export cable route at any given time (COP Volume 1, Section 3.3.14.1; SouthCoast Wind 2024). Recreational vessels may experience delays in the ports serving construction, but most recreational boaters in the geographic analysis area would experience only minor inconvenience from construction-related vessel traffic. Vessel travel requiring a specific route that crosses or approaches the offshore export cable routes could potentially experience minor impacts. Operation of the Proposed Action would have localized, long-term, intermittent, minor impacts on recreational vessel traffic near ports and in open waters. Impacts during decommissioning would be similar to the impacts during construction and installation.

Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned activities. The cumulative impacts from vessels anchoring would be short-term and minor and would be most pronounced when multiple offshore wind projects are under construction at one time. The Proposed Action would incrementally contribute to land disturbance impacts from ongoing and planned activities that disrupt recreational access or enjoyment. Because most land disturbance impacts would be temporary, and overlapping construction activity from the Proposed Action and other projects is anticipated to be minimal, cumulative impacts would be short-term and minor.

The Proposed Action would add to the combined lighting impacts from ongoing and planned activities including offshore wind. The Proposed Action, in combination with other ongoing and planned offshore wind projects, would cause aviation hazard lighting to be potentially visible from 1,048 total WTGs. ADLS would reduce the nighttime impact significance on recreation and tourism to negligible due to substantially limited hours of lighting (COP Appendix T, Section 5.1.3; SouthCoast Wind 2024).

The cumulative impacts of the Proposed Action related to cable emplacement would have minor impacts on recreation and tourism, due to the localized and temporary nature of the impacts and ability of displaced users to use alternate nearby locations during construction and installation, O&M, and decommissioning of offshore export cables. Similarly, noise created as a result of the Proposed Action in combination with other ongoing and planned activities would have minor impacts on recreation and tourism, as construction noise would be temporary and users could avoid elevated noise levels by using alternative locations. Impacts of noise on recreation and tourism during operations would be negligible and long term. The Proposed Action would incrementally contribute to increased port utilization that, combined with other ongoing and planned activities, would have negligible impacts on recreation and tourism because any delays at ports would be short in duration and temporary.

The Proposed Action would contribute incrementally to the combined impacts on recreational boating, fishing, and other marine recreational activity from ongoing and planned activities associated with the presence of structures. The geographic extent of impacts would increase as additional offshore wind projects are constructed, resulting in negligible to minor adverse impacts on recreational fishing, recreational sailing and boating, and for-hire recreational fishing, as well as minor beneficial impacts associated with the artificial reef effect.

Portions of 1,048 WTGs from the Proposed Action combined with future offshore wind projects could be visible from coastal and elevated locations in the geographic analysis area and contribute to impacts on recreation and tourism. The Proposed Action WTGs would contribute the most from the closest locations, including Wasque Point on the southeastern end of Chappaquiddick Island (east of Martha's Vineyard) and Ladies Beach on the southern edge of Nantucket (COP Appendix T, Section 5.3.1, Tables 5-8 and 5-9; SouthCoast Wind 2024). Atmospheric conditions could limit the number of WTGs discernable during daylight hours for a significant portion of the year (COP Appendix T, Section 5.1.3; SouthCoast Wind 2024). The combined visual impacts on recreation and tourism from ongoing and planned activities including offshore wind would be long term, continuous, and minor in the overall geographic area, with moderate impacts on shoreline areas with views of WTGs.

Overlapping construction schedules of the Proposed Action and other offshore wind projects in the geographic analysis area would increase traffic between ports and work areas, requiring increased alertness on the part of recreational or tourist-related vessels, and possibly resulting in a greater number of minor delays or route adjustments. The likelihood of vessel collisions would increase as a result of the higher volumes of vessel traffic during construction. Modest levels of vessel traffic are anticipated from offshore wind operations. In context of reasonably foreseeable environmental trends, incremental impacts contributed by the Proposed Action to the combined vessel traffic impacts on recreation and tourism from ongoing and planned activities would be localized, short term, and minor.

Conclusions

Impacts of the Proposed Action: The impacts of the Proposed Action would be **minor** and **minor beneficial**. Impacts would result from short-term impacts during construction: noise, anchored vessels, and hindrances to navigation from the installation of the export cable and WTGs, as well as the long-term presence of cable hardcover and structures in the Wind Farm Area during operations, with resulting impacts on recreational vessel navigation and visual quality. Beneficial impacts would result from the reef effect and sightseeing attraction of offshore wind energy structures.

Cumulative Impacts of the Proposed Action: In context of other reasonably foreseeable environmental trends, the combination of the Proposed Action and other ongoing and planned activities would result in **moderate** impacts with **minor beneficial** impacts. The main drivers for this impact rating are the visual impacts associated with the presence of structures and lighting; impacts on fishing and other recreational activity from noise, vessel traffic, and cable emplacement during construction; and beneficial impacts on fishing from the reef effect.

3.6.8.6 Impacts of Alternative C on Recreation and Tourism

Impacts of Alternative C: Alternative C would result in similar but slightly greater impacts on recreation and tourism compared to the Proposed Action, but the overall impact magnitudes would be the same. To avoid sensitive fish habitat in the Sakonnet River, the export cable route to Brayton Point under Alternative C-1 and Alternative C-2 would be rerouted onshore. The onshore export cables would be installed in trenches within existing road ROWs where feasible, including road shoulders and medians, but could require pathways on private properties. The Alternative C-1 onshore export cable route would be installed primarily along Route 138, on Aquidneck Island, increasing the total length of the onshore cable route by approximately 9 miles. The Alternative C-2 onshore export cable route would be installed primarily along Routes 77 and 177, in Little Compton and Tiverton, increasing the total length of the onshore cable route by approximately 13 miles (21 kilometers). Similar to the Proposed Action, onshore construction and installation of the export cables would affect recreation and tourism where construction activity interferes with access to recreational sites and from increases in traffic, noise, or temporary emissions that degrade the recreational experience. Construction impacts would have intermittent and short-term impacts on recreation.

Whereas the Proposed Action would make landfall on Aquidneck Island across the road from Island Park Beach, Alternative C-1 would make landfall in the parking lot of Second Beach and Alternative C-2 would make landfall in the parking lot of the Sakonnet Point Marina. Impacts among the landfall locations would be similar, resulting in temporary disruptions to access and increased noise and construction activity that may degrade the recreational experience at these sites during HDD activities. Based on NOAA's Marine Recreational Information Program (NOAA 2022c), shoreside recreational fishing sites may potentially be affected during cable placement activity and maintenance of the Alternative C-1 and Alternative C-2 cable landfalls. Recreational fishing and related sites in proximity to the Alternative C-1 export cable route include Second Beach in Middletown, Rhode Island. Recreational fishing and related sites in proximity to the Alternative C-2 export cable route include the Sakonnet Point Club and Breakwater and Sakonnet Harbor Ramp in Little Compton, Rhode Island, and the Boat House Dock in Tiverton, Rhode Island. Impacts would be temporary during cable installation and use of the sites would not be affected in the long term.

Impacts would be greatest if construction of the landfalls and export cables occurred during the busy summer tourist season. Because the cables are anticipated to be installed largely within existing road ROWs, there would be no permanent impacts on recreational sites, but construction activity could lead to temporarily reduced access to recreational sites and increased traffic, especially on Route 138 in Portsmouth under Alternative C-1, which is a well-traveled four-lane road with year-round tourist traffic. Disruptions in access and increased traffic would occur for a short period at any given location as installation of equipment progresses along the cable routes. The same avoidance measures that SouthCoast Wind has proposed for the Proposed Action would apply for Alternative C, including implementing a Traffic Management Plan and a construction schedule to minimize effects to tourism related activities, including coordinating with stakeholders/visitors' bureaus to schedule outside of major events and avoiding construction during the summer tourist season (COP Volume 2, Table 16-1; SouthCoast Wind 2024). Because these impacts would be temporary, lasting only during installation activities, and with implementation of the avoidance measures proposed by SouthCoast Wind, impacts under Alternative C are anticipated to localized, short-term, minor.

Cumulative Impacts of Alternative C: In the context of reasonably foreseeable environmental trends, the cumulative impacts of Alternative C would be similar to those described under the Proposed Action.

Conclusions

Impacts of Alternative C: While the onshore cable route to Brayton Point would differ under Alternatives C-1 and C-2, the overall impact magnitudes are anticipated to be the same as those of the Proposed Action, which is anticipated to be **minor** adverse and **minor** beneficial on recreation and tourism.

Cumulative Impacts of Alternative C: In context of reasonably foreseeable environmental trends, BOEM anticipates that the cumulative impacts of Alternative C would be the same as the Proposed Action—**moderate** and **minor beneficial**.

3.6.8.7 Impacts of Alternative D (Preferred Alternative) on Recreation and Tourism

Impacts of Alternative D: Alternative D would involve the installation of six fewer WTGs than the Proposed Action, which would reduce the construction impact footprint and installation period. Construction of fewer WTGs would result in a negligible reduction of impacts on visual resources compared to the Proposed Action, unnoticeable to the casual viewer. Alternative D could reduce gear entanglements and loss, as well as allisions, and recreational fishing may slightly decrease due to fewer structures providing reef habitat for targeted species. Fewer vessels and vessel trips would be expected, which would reduce the risk of discharges, fuel spills, and trash in the area and the risk of collision with marine mammals and sea turtles.

Cumulative Impacts of Alternative D: In the context of reasonably foreseeable environmental trends, the cumulative impacts of Alternative D would be similar to those described under the Proposed Action.

Conclusions

Impacts of Alternative D: The **minor** impacts and **minor beneficial** impact associated with the Proposed Action would not change substantially under Alternative D. The impacts associated with Alternative D would be slight improvements over the Proposed Action's impacts, but the impact level would not change.

Cumulative Impacts of Alternative D: In context of reasonably foreseeable environmental trends, BOEM anticipates that the cumulative impacts of Alternative D would be the same as the Proposed Action—**moderate** and **minor beneficial**.

3.6.8.8 Impacts of Alternatives E and F on Recreation and Tourism

Impacts of Alternatives E and F: Alternative E, which would involve installing a range of foundation types (piled foundations under Alternative E-1; suction bucket foundations under Alternative E-2; or GBS under Alternative E-3), and Alternative F, which would allow for up to three HVDC offshore export cables to Falmouth (as opposed to the maximum of 5 as proposed under the Proposed Action), would not have measurable impacts on recreation and tourism that are materially different from the impacts of the Proposed Action.

Cumulative Impacts of Alternatives E and F: In the context of reasonably foreseeable environmental trends, the cumulative impacts of Alternatives E and F would be similar to those described under the Proposed Action.

Conclusions

Impacts of Alternatives E and F: The impacts of Alternatives E and F on recreation and tourism would be the same as those of the Proposed Action. Impacts would be **minor** impacts and **minor beneficial**.

Cumulative Impacts of Alternatives E and F: In context of reasonably foreseeable environmental trends, BOEM anticipates that the cumulative impacts of Alternatives E and F would be the same as the Proposed Action—**moderate** and **minor beneficial**.

3.6.8.9 Comparison of Alternatives

Alternative C would reroute the Brayton Point offshore export cable corridor onshore to avoid sensitive fish habitat in the Sakonnet River. Similar to the Proposed Action, onshore construction and installation of the export cables would affect recreation and tourism where construction activity interferes with access to recreational sites and from increases in traffic, noise, or temporary emissions that degrade the recreational experience. Under Alternative D, six fewer WTGs would be installed, which would reduce the construction impact footprint and installation period, and result in a negligible reduction of impacts on recreation and tourism as compared to the Proposed Action. Alternatives E and F would result in modifications to offshore aspects of the PDE that are unlikely to have impacts on recreation and tourism and would not result in impacts that are materially different from the impacts of the Proposed Action. Although Alternatives C, D, E, and F modify components of the PDE or restrict what aspects of the PDE are approved, the modifications would not materially change the analysis of any IPF for any resource analyzed under recreation and tourism when compared to the Proposed Action; therefore, the overall impact level would be the same as under the Proposed Action: **minor** adverse and **minor beneficial** impacts.

In the context of reasonably foreseeable environmental trends, the contributions of Alternatives C, D, E, and F to the cumulative impacts on recreation and tourism would be the same as that described under the Proposed Action: **moderate** adverse and **minor beneficial**.

3.6.8.10 Proposed Mitigation Measures

No measures to mitigate impacts on recreation and tourism have been proposed for analysis.