Wind Energy Research Lease on the Atlantic Outer Continental Shelf Offshore Maine

Environmental Assessment

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Wind Energy Research Lease on the Atlantic Outer Continental Shelf Offshore Maine

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Executive Summary

ES.1 Introduction

This environmental assessment (EA) was prepared in accordance with the National Environmental Policy Act (NEPA) to consider the reasonably foreseeable environmental consequences associated with the issuance of a wind energy research lease to the State of Maine. Issuance of the research lease would not authorize any activities on the U.S. Outer Continental Shelf (OCS) but would result in site assessment activities (i.e., placement of a meteorological ocean buoy) within the lease and site characterization activities (i.e., geophysical and geotechnical [G&G], biological, and archaeological surveys and monitoring activities) within and around the lease and potential future project easements. Information gathered from site assessment and site characterization activities would be used by the State of Maine to develop a detailed research activities plan (RAP) for potential future construction and operation of floating offshore wind turbines, installation of inter-array and export cables, and associated wind energy-related research facilities, which the Bureau of Ocean Energy Management (BOEM) would evaluate in a subsequent environmental analysis after receiving the RAP. This EA does not consider construction and operation of any commercial wind energy facilities within the Gulf of Maine, which, if proposed, would be evaluated by BOEM as a separate NEPA action. Future development of the research lease could contribute to the achievement of Maine's renewable energy goals and provide an opportunity to test floating offshore wind turbine technology for commercial use.

ES.2 Purpose and Need for Action

The purpose of the Proposed Action is to issue a wind energy research lease on the OCS of the Gulf of Maine. BOEM's issuance of this lease is needed:

(a) to confer upon the lessee the exclusive right to submit a site assessment plan (SAP) and a RAP to BOEM for potential development, such that the lessee will commit to site characterization and site assessment activities necessary to determine the suitability of its lease and potential future project easements for offshore wind production and/or transmission and develop plans for BOEM's review; and

(b) to impose terms and conditions intended to ensure that site assessment and site characterization activities are conducted in a safe and environmentally responsible manner.

ES.3 Proposed Action and Alternatives

The Proposed Action for this EA is the issuance of a wind energy research lease in support of wind energy development in the Gulf of Maine. Issuance of the research lease would only allow for the submittal of an SAP and a RAP for BOEM's consideration and approval, which does not constitute an irreversible and irretrievable commitment of resources. Therefore, BOEM's environmental analysis focuses on the effects of site characterization and site assessment activities that are expected to take place after the issuance of the wind energy research lease. The Proposed Action would result in site assessment activities within the lease and site characterization activities within and around the lease and potential future project easements. Site assessment activities may include the temporary placement of a meteorological ocean buoy. Site characterization activities may include G&G, biological, and archaeological surveys and monitoring activities. BOEM would require the lessee to avoid or minimize potential impacts on the environment by complying with standard operating conditions and mitigation. **Figure ES-1** shows the location of the approximately 68,320-acre (276-square-kilometer) area within the Gulf of Maine (referred to in this EA as the Research Lease Area) for which BOEM determined there was no competitive interest after issuing a Request for Competitive Interest (RFCI) (87 *Federal Register* 51134). Within the Research Lease Area, BOEM would issue a research lease not to exceed 10,000 acres (40.5 square kilometers) and would site the lease in a location that minimizes impacts on navigation. **Figure ES-1** also shows the State of Maine's narrowed area of interest (34,596 acres [140 square kilometers]) and requested lease area (9,728 acres [39.4 square kilometers]) for potential installation of the Research Array pending approval of a RAP. Certain site characterization surveys would also be conducted within potential future project easements between the lease and the shoreline to evaluate potentially suitable locations for future installation of submarine export cables and wet storage of wind turbine generators prior to installation—information that would be needed to prepare a RAP after lease issuance.

Table ES-1 summarizes the two alternatives analyzed in this EA.

Table ES-1. Alternatives analyzed in detail

Alternative	Description
No Action	Under the No Action Alternative, BOEM would not issue a wind energy research lease to the State of Maine and site assessment activities would not occur within the leased area of the Gulf of Maine. Although some site characterization surveys (e.g., geological, geophysical, biological, and archaeological surveys conducted on unleased or ungranted areas of the OCS) do not require BOEM approval and could still be conducted under the No Action Alternative, these activities are less likely to occur without a research lease.
Proposed Action	Under the Proposed Action, BOEM would issue a wind energy research lease in support of wind energy development in the Gulf of Maine. The Proposed Action would result in site assessment activities within the lease and site characterization activities within the lease, and between the lease and shoreline along the potential export cable corridors and wet storage area. Information gathered from these survey and monitoring activities would be used by the State of Maine to develop a detailed RAP for potential future construction and operation of floating offshore wind turbines, installation of inter-array and export cables, and associated wind energy-related research facilities.

ES.4 Foreseeable Activities and Impact-Producing Factors

The analysis covers the effects of routine and non-routine activities associated with issuance of a wind energy research lease and related site assessment and site characterization activities within and around the lease and potential future project easements. The State of Maine provided information about planned site assessment and site characterization activities including the general location, timing, and frequency of the activities and the types of equipment and vessels likely to be used, if known at this time. Reasonably foreseeable non-routine and low-probability events and hazards that could occur during lease issuance–related activities include (1) severe storms, such as hurricanes and extratropical cyclones; (2) allisions and collisions between the site assessment structure or survey vessels and other marine vessels or marine life; (3) spills from collisions or fuel spills resulting from generator refueling; and (4) recovery of lost survey equipment.

Impact-producing factors (IPFs) associated with the various activities in the Proposed Action that could affect resources include the following:

- Air emissions
- Noise
- Lighting
- Seafloor disturbance
- Entanglement
- Routine vessel discharges
- Vessel traffic and space-use conflicts

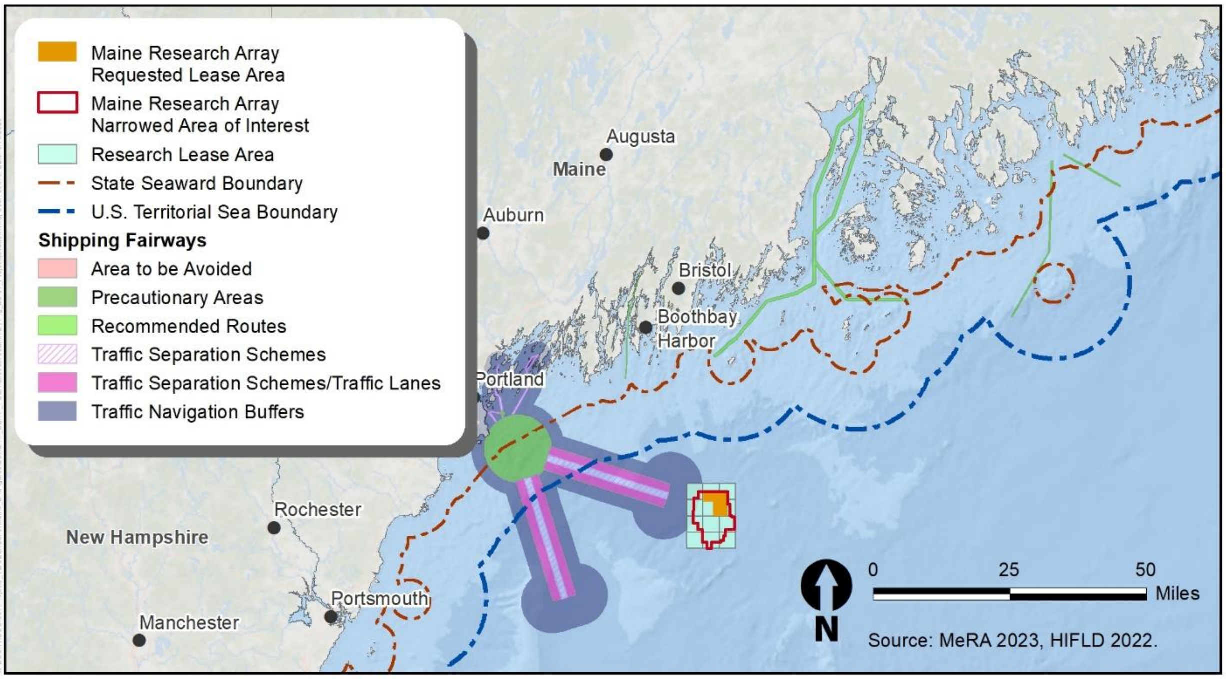

Figure ES-1. Location of Research Lease Area

ES.5 Environmental Consequences

This EA uses a four-level classification scheme (negligible, minor, moderate, and major) to characterize the environmental impacts predicted for each alternative. **Table ES-2** summarizes potential impacts that could occur under the Proposed Action. Under the No Action Alternative, any potential environmental and socioeconomic impacts, including benefits, associated with the Proposed Action would not occur; however, impacts could occur from other ongoing and planned activities (**Section 4.2**).

Overall, the incremental effects of the Proposed Action are predicted to range from negligible to minor due to the temporary and localized nature of the site assessment and site characterization activities. See **Section 3.3** for a description of potential impacts on each resource.

Table ES-2. Summary of impact determinations for the Proposed Action

Resource	Impact Determination: Proposed Action		
	Routine Activities		Non-Routine Events
	Site Assessment	Site Characterization	
Air Quality and Greenhouse Gas Emissions	Negligible	Negligible	Negligible
Water Quality	Negligible	Negligible	Negligible
Benthic Resources	Negligible to Minor	Negligible to Minor	Negligible
Finfish, Invertebrates, and Essential Fish Habitat	Negligible	Negligible	Negligible
Marine Mammals	Negligible to Minor	Negligible to Minor	Negligible
Sea Turtles	Negligible	Negligible to Minor	Negligible
Military Use	Negligible	Negligible	Negligible
Navigation and Vessel Traffic	Negligible to Minor	Negligible to Minor	Negligible
Commercial and Recreational Fishing	Negligible to Minor	Negligible to Minor	Negligible
Recreation and Tourism	Negligible	Negligible	Negligible
Cultural, Historical, and Archaeological Resources	Negligible	Negligible	Negligible

Note: Site assessment activities include buoy deployment, operation, and decommissioning; site characterization activities include G&G, physical oceanographic, biological, and archaeological surveys and monitoring activities.

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List of Abbreviations and Acronyms

°C	degrees Celsius
AIS	Automated Identification System
ASLF	ancient submerged landform feature
ASMFC	Atlantic States Marine Fisheries Commission
BA	biological assessment
BIA	biologically important area
BOEM	Bureau of Ocean Energy Management
BSEE	Bureau of Safety and Environmental Enforcement
CFR	Code of Federal Regulations
CO	carbon monoxide
dB	decibel
DOD	U.S. Department of Defense
DPS	distinct population segment
EA	environmental assessment
EBM	ecosystem-based management
EFH	essential fish habitat
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FLiDAR	floating light detection and ranging
ft^2	square feet
G&G	geophysical and geotechnical
GAA	geographic analysis area
GHG	greenhouse gas
HAPC	habitat area of particular concern
HMA	Habitat Management Area
HRG	high-resolution geophysical
Hz	Hertz
IPF	impact-producing factor
kHz	kilohertz
km	kilometer
km^2	square kilometer
m^2	square meters
NAAQS	National Ambient Air Quality Standards
NARW	North Atlantic right whale
NEFMC	New England Fishery Management Council
NEPA	National Environmental Policy Act
nm	nautical mile
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent

NO_X	nitrogen oxides
O_3	ozone
OCS	Outer Continental Shelf
PBR	potential biological removal
PM10	particulate matter with a diameter less than or equal to 10 micrometers
PM2.5	particulate matter with a diameter less than or equal to 2.5 micrometers
PSO	protected species observer
PTS	permanent threshold shift
RAP	research activities plan
re 1 µPa	referenced to 1 micropascal
Research Array	array of up to 12 floating offshore wind turbines
Research Lease Area	68,320-acre (276-square-kilometer) area within the Gulf of Maine in which BOEM could issue a wind energy research lease
RFCI	Request for Competitive Interest
RFI	Request for Interest
SAP	site assessment plan
SHPO	State Historic Preservation Office
SO_2	sulfur dioxide
SOC	standard operating condition
SPL	sound pressure level
Task Force	Gulf of Maine Intergovernmental Renewable Energy Task Force
TIMS	Technical Information Management System
TSS	traffic separation scheme
UME	Unusual Mortality Event
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
VMS	Vessel Monitoring System
VOC	volatile organic compound

1 Purpose and Need for Action

1.1 Introduction

This environmental assessment (EA) was prepared by the Bureau of Ocean Energy Management (BOEM) in accordance with the National Environmental Policy Act (NEPA) to consider the reasonably foreseeable environmental consequences associated with the issuance of a research lease to the State of Maine. The Proposed Action for this EA is the issuance of a wind energy research lease in support of wind energy development in the Gulf of Maine. The research lease would not authorize any activities on the U.S. Outer Continental Shelf (OCS) but would result in site assessment activities (i.e., placement of a meteorological ocean buoy) within the lease and site characterization activities (i.e., geophysical and geotechnical [G&G], biological, and archaeological surveys and monitoring activities) within and around the lease and potential future project easements.

Issuance of the research lease would also give the State of Maine the exclusive right to submit a detailed site assessment plan (SAP) and a research activities plan (RAP) for wind energy-related research activities offshore Maine. The research lease application submitted to BOEM by the State of Maine in October 2021 included a preliminary plan for development of an array of up to 12 floating offshore wind turbines (Research Array) on the OCS offshore Maine capable of generating up to 144 megawatts of renewable energy (State of Maine, 2021). Prior to the approval of any plan authorizing the construction and operation of the Research Array, installation of inter-array and export cables, and associated wind energy-related research facilities, which is outside the scope of this EA, BOEM would prepare a subsequent plan-specific environmental analysis.

Maine has ambitious renewable energy goals and views offshore wind as an important component of its strategy to address climate change. Water depths in the Gulf of Maine would require floating offshore wind foundations, a relatively new technology. In pursuing the development of the Research Array, the State hopes to position itself as a hub for floating offshore wind development in the region, while advancing a set of informed best practices and standards for commercial-scale floating offshore wind projects in the Gulf of Maine for use in planning, permitting, and constructing commercial-scale projects in a fashion that optimizes coexistence with traditional marine users and the ecosystem.

Table 1-1 summarizes the history of planning and leasing activities offshore Maine associated with the requested research lease. BOEM is conducting a separate but related commercial planning and leasing process concurrently with research leasing processes. More information about the research lease and commercial leasing processes is available on BOEM's website: https://www.boem.gov/renewable-energy/state-activities/maine/gulf-maine.

Table 1-1. History of planning and leasing activities for the Gulf of Maine research lease

Date	Milestone
October 1, 2021	BOEM received an application from the State of Maine filed pursuant to 30 CFR 585.239 for a research lease requesting 9,728 acres (39.4 km^2) on the OCS in a location more than 20 nm (37 km) offshore Maine (State of Maine, 2021). Prior to submitting the research lease application, the State of Maine completed a multi-stage site identification process that included public input to identify a preferred site for installation of the Research Array.
June 22, 2021	Governor Janet Mills signed Legislative Document 336 (Senate Paper 142), which directs the Maine Public Utilities Commission to enter into contract negotiations for a power purchase agreement for energy generated (up to 144 megawatts) from the Research Array should the State's application be successful.
July 6, 2021	Governor Janet Mills signed Legislative Document 1619 (Senate Paper 512), which prohibited offshore wind development within territorial waters and submerged lands and created a research consortium to oversee the research strategy and priorities for the Research Array.
August 17, 2022	BOEM prepared a decision memorandum in response to the State of Maine's research lease request that documents the analysis and rationale used to develop a recommendation to issue an RFCI in the area proposed for the research lease (BOEM, 2022b).
August 19, 2022	BOEM published an RFCI for an area of approximately 68,320 acres (276 km^2) in the Gulf of Maine in the *Federal Register* for a 45-day public comment period (87 *Federal Register* 51134). BOEM issued this RFCI because regulations require that BOEM identify whether there is competitive commercial interest in any area that is the subject of an unsolicited lease request (i.e., the research lease application). The RFCI encompassed a broader area than identified in the State of Maine's application to provide BOEM with flexibility to address any other potential conflicts that may be identified in the future that would result in areas of the RFCI not being suitable for leasing. Comment submissions can be viewed by visiting the federal eRulemaking Portal: http://www.regulations.gov. In the search box at the top of the web page, enter BOEM-2022-0041 and then click "search."
January 19, 2023	BOEM announced its DNCI for a research lease proposed by the State of Maine (BOEM, 2023a).
March 20, 2023	BOEM published the DNCI in the *Federal Register* (88 *Federal Register* 16662). This determination allowed BOEM to begin processing the State's research lease application.
May 4, 2023	BOEM published a Notice of Intent to prepare this EA in the *Federal Register* for a 30-day public comment period that closed on June 5, 2023 (88 *Federal Register* 28611). Public comments received were considered in the preparation of this EA.

CFR = Code of Federal Regulations; DNCI = Determination of No Competitive Interest; km = kilometer; km^2 = square kilometer; nm = nautical mile; RFCI = Request for Competitive Interest

1.2 Purpose and Need for Action

The purpose of the Proposed Action is to issue a wind energy research lease on the OCS of the Gulf of Maine. BOEM's issuance of this lease is needed:

(a) to confer upon the lessee the exclusive right to submit an SAP and a RAP to BOEM for potential development, such that the lessee will commit to site characterization and site assessment activities necessary to determine the suitability of its lease and potential future project easements for offshore wind production and/or transmission and develop plans for BOEM's review; and

(b) to impose terms and conditions intended to ensure that site assessment and site characterization activities are conducted in a safe and environmentally responsible manner.

1.3 Relevant Existing NEPA and Consulting Documents

Table 1-2 identifies key NEPA and consulting documents used to inform this EA, which are incorporated by reference. Other sources are cited throughout the document as appropriate and listed in **Appendix D**. BOEM also considered the following information in preparing this EA:

- Comments received in response to the August 19, 2022, Request for Competitive Interest (RFCI) for the research lease
- Comments received in response to the May 6, 2023, Notice of Intent (NOI) to prepare this EA
- Ongoing consultation and coordination with the members of BOEM's Gulf of Maine Intergovernmental Renewable Energy Task Force (Task Force)
- Ongoing or completed consultations and coordination with other federal agencies, including the Bureau of Safety and Environmental Enforcement (BSEE), U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), U.S. Department of Defense (DOD), National Park Service, and U.S. Coast Guard (USCG)

Table 1-2. Relevant existing NEPA and consulting documents

Reference	Relevance
Avanti Corporation, Industrial Economics, Inc. 2019. National Environmental Policy Act documentation for impact-producing factors in the offshore wind cumulative impacts scenario on the North Atlantic continental shelf. Sterling (VA): U.S. Department of the Interior, Bureau of Ocean Energy Management. 201 p. Report No.: OCS Study BOEM 2019-036. [accessed 2023 May 15]. https://www.boem.gov/sites/default/files/environmental-stewardship/Environmental-Studies/Renewable-Energy/IPFs-in-the-Offshore-Wind-Cumulative-Impacts-Scenario-on-the-N-OCS.pdf.	Establishes a common cumulative impacts scenario framework for use in NEPA analyses for offshore wind activities on the North Atlantic OCS, including actions and activities that may affect the same physical, biological, economic, or cultural resources as the renewable energy actions.
Minerals Management Service (MMS). 2007. Programmatic environmental impact statement for alternative energy development and production and alternate use of facilities on the Outer Continental Shelf. Final environmental impact statement. Herndon (VA): U.S. Department of the Interior, Minerals Management Service. 4 vols. Report No.: OCS EIS/EA MMS 2007-046. [accessed 2023 May 15]. https://www.boem.gov/renewable-energy/guide-ocs-alternative-energy-final-programmatic-environmental-impact-statement-eis.	Programmatically examines the potential impacts of alternative energy and alternate-use activities that may occur on the OCS, including through federal issuance of leases and associated site assessment and characterization activities.

Reference	Relevance
BOEM. 2023b. Gulf of Maine research lease environmental assessment draft biological assessment for the National Marine Fisheries Service.	Appendix A of the biological assessment contains PDCs and BMPs to avoid, minimize, and mitigate impacts on ESA-listed species during data collection and site survey activities for renewable energy on the Atlantic OCS.
BOEM. 2022a. Decision Memorandum. Gulf of Maine request for competitive interest (RFCI). Washington (DC): U.S. Department of the Interior, Bureau of Ocean Energy Management. 25 p. [accessed 2023 May 15]. https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/GoME%20RFCI%20Decision%20Memo.pdf.	Documents the analysis and rationale used to develop a recommendation to issue an RFCI for the area proposed by the State of Maine for a research lease and identifies conflicts between the recommended RFCI area and existing ocean users.
BOEM. 2022b. Conditions of construction and operations plan approval. Lease number OCS-A 0517. Washington (DC): U.S. Department of the Interior, Bureau of Ocean Energy Management. 93 p. [accessed 2023 May 24]. https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/SFWF-COP-Terms-and-Conditions.pdf.	Section 5.5 contains mitigation measures developed through project-specific consultation under Section 7 of the ESA for the approved Construction and Operations Plan for the South Fork Wind Farm and South Fork Export Cable Project, which BOEM has also identified as applicable to the Proposed Action in this EA, particularly for fish surveys.

BMP = best management practice; ESA = Endangered Species Act; PDC = project design criterion

2 Alternatives

2.1 No Action Alternative

Under the No Action Alternative, BOEM would not issue a wind energy research lease to the State of Maine and site assessment activities would not occur within the leased area of the Gulf of Maine. Although some site characterization surveys (e.g., geological, geophysical, biological, and archaeological surveys conducted on unleased or ungranted areas of the OCS) do not require BOEM approval and could still be conducted under the No Action Alternative, these activities are less likely to occur without a research lease.

2.2 Proposed Action

The Proposed Action for this EA is the issuance of a wind energy research lease within portions of an approximately 68,320-acre (276-square-kilometer [km^2]) area (referred to in this EA as the Research Lease Area) of the OCS in the Gulf of Maine (see **Figure 2-1**). Under the Proposed Action, BOEM would issue a research lease not to exceed 10,000 acres (40.5 km^2) and would site the lease in a location within the Research Lease Area that minimizes impacts on navigation. On March 6, 2023, USCG announced the completion of the Approaches to Maine, New Hampshire, and Massachusetts Port Access Route Study (88 *Federal Register* 20547). The analysis recommended a new shipping fairway exiting the Portland Eastern Approach Traffic Separation Scheme (TSS) that would intersect the State of Maine's requested lease location. Should this recommendation move forward, BOEM may issue a lease in another portion of the Research Lease Area to minimize future use conflicts with offshore wind. **Figure 2-1** also shows the State of Maine's narrowed area of interest (34,596 acres [140 km^2]) and requested lease area (9,728 acres [39.4 km^2]) for potential installation of the Research Array pending approval of a RAP.

The Proposed Action would result in site assessment activities within the lease. Site assessment activities may include the temporary placement (i.e., deployment, maintenance, and decommissioning) of a meteorological ocean buoy. Site characterization activities may include G&G, biological, and archaeological surveys and monitoring activities. Certain site characterization surveys would be conducted within and around the lease and between the lease and the shoreline to evaluate potentially suitable locations for future installation of submarine export cables and wet storage of wind turbine generators prior to installation—information that would be needed to prepare a RAP after lease issuance.

The research lease would not authorize any activities on the OCS but would grant the State of Maine the exclusive rights to submit, for BOEM's potential approval, an SAP and a RAP for wind energy-related research activities offshore Maine. Prior to the approval of any plan authorizing the construction and operation of wind energy-related research facilities, BOEM would prepare a plan-specific environmental analysis and would comply with all required consultation requirements.

Under the Proposed Action, BOEM would require each lessee to avoid or minimize potential impacts on the environment by complying with various requirements. These requirements, which are summarized in **Chapter 5**, are referred to as standard operating conditions (SOCs) and mitigation and would be implemented through lease stipulations. Although certain site assessment and site characterization activities may require permits from other agencies, such as a U.S. Army Corps of Engineers (USACE)

Nationwide Permit, BOEM's responsibilities are limited to ensuring consistency with requirements from Endangered Species Act (ESA) consultations with NMFS and USFWS. BOEM does not issue permits or authorizations for site assessment or site characterization activities for offshore wind. **Table 2-2** lists anticipated permits or authorizations needed from federal and state agencies.

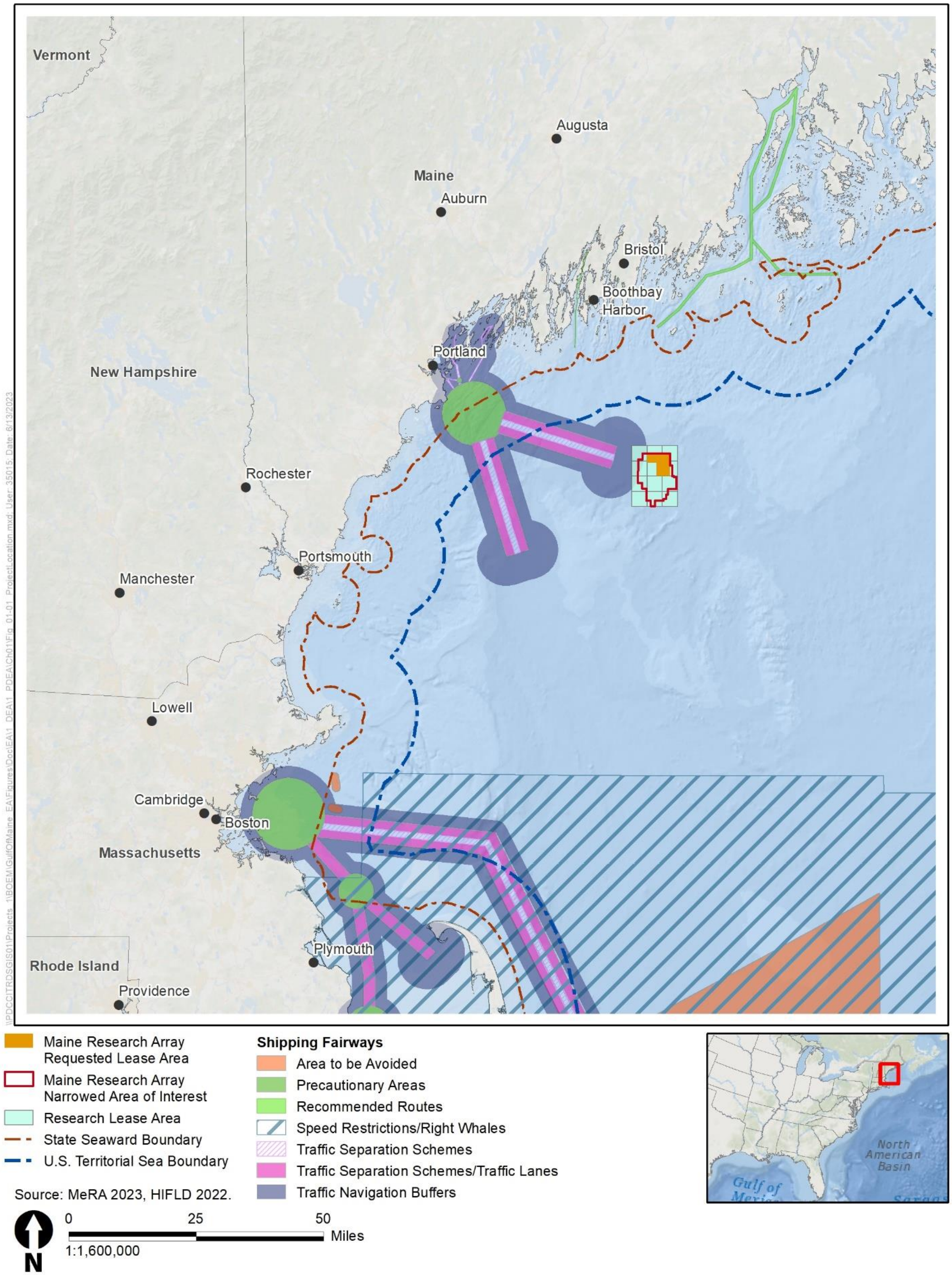

Figure 2-1. Location of Research Lease Area

2.2.1 Site Assessment and Site Characterization Activities

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

Survey or Monitoring Activity	Description	Activity Frequency and Timing	Port	Vessel Type	Equipment or Method
Site Assessment Activities					
FLiDAR Buoy-based Acoustic Monitoring[1] – Deployment and Maintenance	PTOW would deploy a FLiDAR buoy in the Research Lease Area to collect and transmit information on wind, waves, currents, sea level, and other meteorological parameters in real time. The FLiDAR buoy diameter is 9.5 feet (2.9 meters), with an overall height of 23 feet (6.8 meters), and approximate weight of 5,512 pounds (2,500 kg). The buoy would be moored with a single gravity anchor estimated to be approximately 6,000 pounds (2,722 kg) and is not expected to exceed a footprint of 32 ft^2 (3 m^2).	4 total vessel trips anticipated for deployment, maintenance (2 trips), and decommissioning. Anticipated 24-month buoy deployment (March 2024 through February 2026).	Boston, MA or Portland, ME	Crew boat up to 200 feet (61 meters) in length.	Fugro SEAWATCH Wind FLiDAR buoy equipped with an independent tracker and dual global positioning system to allow for real-time position monitoring. Primary power from solar panels with backup energy supplied by methanol fuel cells in the hull.

Survey or Monitoring Activity	Description	Activity Frequency and Timing	Port	Vessel Type	Equipment or Method
FLiDAR Buoy-based Acoustic Monitoring – Decommissioning	Decommissioning is essentially the reverse of the deployment process. Equipment recovery would be performed with the support of a vessel equivalent in size and capability to that used for deployment. Typically for small buoys, a crane-lifting hook would be secured to the buoy. A water/air pump system would de-ballast the buoy, causing it to tip into the horizontal position. The mooring chain and anchor would be recovered to the deck using a winching system. The buoy would then be transported to shore. Buoy decommissioning is expected to be completed within 1 to 2 days.	See previous row.	See previous row.	See previous row.	See previous row.

Survey or Monitoring Activity	Description	Activity Frequency and Timing	Port	Vessel Type	Equipment or Method
Site Characterization Activities					
Geophysical Reconnaissance Surveys[2]	PTOW would conduct geophysical reconnaissance surveys of the Research Lease Area, potential export cable routes, and wet storage area identified in the State of Maine's research lease application. The surveys would cover a broader area and collect relatively lower-resolution data to identify specific locations for subsequent high-resolution geophysical surveys.	15 multi-day trips by 24-hour vessel. Each multi-day trip would be approximately 7–14 days depending on many factors, including weather downtime, vessel replenishment, and crew changes. 60 daily trips by 12-hour vessel. September 2023 through November 2023.	Portland, ME	24-hour vessel, with length of approximately 164 feet (50 meters), for offshore locations. 12-hour vessel, with length of approximately 49 feet (15 meters), for nearshore and inshore locations.	Hull-mounted multibeam echosounder with backscatter measurement (proxy for seafloor hardness) and a parametric sub-bottom profiler (e.g., Innomar) with directional chirp signal with operation frequency of 30–115 kHz. The sensors are of such frequency and amplitude level to not require Incidental Harassment Authorization for marine mammals.
High-Resolution Geophysical Surveys[2,3]	PTOW would conduct high-resolution geophysical surveys of the Research Lease Area, potential export cable routes, and wet storage area identified in the State of Maine's research lease application. The surveys would collect bathymetrical (seafloor depth), morphological (topography), and geological data to inform various charting, interpretation, analyses, and reporting efforts for the State of Maine's research project, including assessment of archaeological resources.	15 multi-day trips by 24-hour vessel. Each multi-day trip would be approximately 7–14 days depending on many factors, including weather downtime, vessel replenishment, and crew changes. 60 daily trips for 12-hour vessel. March 2024 through October 2024.	Portland, ME	24-hour vessel, with length of approximately 164 feet (50 meters) for offshore locations. 12-hour vessel, with length of approximately 49 feet (15 meters) for nearshore and inshore locations.	Multibeam echosounder, side-scan sonar, parametric sub-bottom profiler, magnetometer, and ultrahigh-resolution seismic imaging.

Survey or Monitoring Activity	Description	Activity Frequency and Timing	Port	Vessel Type	Equipment or Method
Geotechnical Surveys[2,3]	PTOW would conduct geotechnical surveys of the Research Lease Area, potential export cable routes, and wet storage area identified in the State of Maine's research lease application. The surveys would sample or test seabed characteristics to inform design specifications of and locations suitable for placement of anchors and cable infrastructure.	30 multi-day trips. Each multi-day trip would be approximately 7–14 days depending on many factors, including weather downtime, vessel replenishment, and crew changes. March 2024 through October 2024.	Portland, ME	Vessel with a length of approximately 246–262 feet (75–80 meters).	Shallow geotechnical coring (piston or vibracores) and cone penetration testing. The number and location of test sites would be determined based on the results of the geophysical reconnaissance survey, likely up to several hundred test sites.
Benthic Surveys[3]	PTOW would conduct detailed benthic surveys of the Research Lease Area, potential export cable routes, and wet storage area identified in the State of Maine's research lease application. The surveys would be used to characterize seafloor habitats of the RFCI area, export cable routes, and wet storage area identified in the State of Maine's research lease application.	Expected to require 30 multi-day trips, conducted as part of G&G surveys. September 2023 through October 2023.	Portland, ME	See geophysical reconnaissance and G&G surveys.	Benthic grabs (Hamon grab or Van Veen grab), sediment profile imaging/plan view cameras, and underwater video. The number and location of benthic grab sites would be determined based on the results of the geophysical reconnaissance survey, likely up to several hundred grab sites.

Survey or Monitoring Activity	Description	Activity Frequency and Timing	Port	Vessel Type	Equipment or Method
Seafloor Habitat Characterization Sampling and Surveys	DMR would conduct sampling and surveys of the Research Lease Area, potential export cable routes, and wet storage area identified in the State of Maine's research lease application to characterize seafloor habitat and benthic infauna species composition. Data collected would include water column profiles; average seafloor values for temperature, pH, chlorophyll, dissolved oxygen, and salinity; surficial sediment information; seafloor video; benthic species composition; bathymetry; and backscatter.	Once annually. Number of trips per annual survey depends on steam time of contracted vessel. Beginning in Quarter 1 2023 and continuing until approval of the RAP.[4]	Boothbay, ME	45-foot (14-meter) research vessel capable of deploying/retrieving sampling equipment at depth.	Seafloor sampling with benthic grab. Multibeam sonar surveys. The number and location of benthic grab sites would be determined based on the results of the geophysical reconnaissance survey, likely up to several hundred grab sites.

Survey or Monitoring Activity	Description	Activity Frequency and Timing	Port	Vessel Type	Equipment or Method
Physical Oceanographic Monitoring	DMR would conduct monitoring to characterize the physical oceanographic conditions and surface wind conditions in and around the Research Lease Area. Above-water and surface data would be collected from existing shore-based radar stations with 3.1-mile (5-km) resolution operated by the State of Massachusetts. Two additional radar stations with 1.2-mile (2-km) resolution would be installed along the Maine coast in the first year after lease issuance. In following years, one to three additional radar stations may be installed. Subsurface water data on water column temperature, salinity, chlorophyll a concentration, and suspended particulate concentration would be collected with an underwater glider following a bowtie or sawtooth pattern around the Research Lease Area.	Beginning in July 2023 and continuing until approval of the RAP.[4] Monitoring from shore-based radar stations would occur continuously. Glider deployments would occur monthly or less frequently based on data needs.	Undetermined. Portland, ME assumed for analysis.	45-foot (14-meter) research vessel capable of deploying/retrieving sampling equipment at depth.	Shore-based radar stations. Underwater glider.

Survey or Monitoring Activity	Description	Activity Frequency and Timing	Port	Vessel Type	Equipment or Method
Digital Aerial Surveys	PTOW would work with HiDef and Biodiversity Research Institute to conduct high-definition digital aerial surveys of the Research Lease Area to sample and map seasonal occurrence and activity of birds, bats, marine mammals, sea turtles, and large fish. Surveys would focus on birds and document the number of individuals, distribution, behaviors (e.g., foraging, flying, resting), and flight height and direction (if applicable). Four surveys would be extensions to BOEM's quarterly bird surveys; there would be eight standalone surveys.	12 flights total, conducted monthly. April 2023 through March 2024, with possible extension through March 2025.	Flights from Plymouth, MA	Fixed-wing aircraft	High-resolution digital video cameras mounted on a fixed-wing aircraft flying at an altitude of approximately 1,312 feet (400 meters) and ground speed of approximately 137 mph (220 kph or 120 knots), providing imagery at 0.6-inch (1.5-centimeter) ground sample distance. Initially, surveys would cover the entire RFCI area, but may be reduced to cover the Research Lease Area plus a 2.5-mile (4-km) buffer.

Survey or Monitoring Activity	Description	Activity Frequency and Timing	Port	Vessel Type	Equipment or Method
Visual Wildlife Surveys	Biodiversity Research Institute, in cooperation with the Gulf of Maine Research Institute, would conduct visual surveys along fixed transects to confirm marine mammal, bird, and sea turtle species utilization of the Research Lease Area, with emphasis on endangered and threatened species. The surveys would also assess information variability and uncertainty associated with baseline surveys. All observers would document species ID, location, group size, distance and bearing from vessel, flight height for birds, and behavior for each sighting as well as sea state, time of day, glare, and fishing activity in the area.	Number of trips per month depends on the vessel type, steam time, and port location. Beginning in 2023 and continuing until approval of the RAP.[4]	Undetermined. Portland, ME assumed for analysis.	Depends on contracted industry vessel. Crew boat less than 65 feet (19 meters) in length with elevated platform for observations assumed for analysis.	Surveys would be conducted by two bird observers, trained by the Maine Department of Inland Fisheries and Wildlife for protected species and bird observations, and four marine mammal observers, trained as protected species observers. Vessels would follow fixed transects and would not deviate to intercept marine mammals; vessel speed would not exceed 11.5 mph (18.5 kph or 10 knots).

Survey or Monitoring Activity	Description	Activity Frequency and Timing	Port	Vessel Type	Equipment or Method
Passive Acoustic Monitoring of Marine Mammals and Ambient Noise	DMR would conduct passive acoustic monitoring to characterize marine mammal utilization of the Research Lease Area and to quantify levels of ambient noise. The mooring suites would be spaced across the Research Lease Area and vicinity to incorporate into a larger network across the Gulf of Maine used for location and tracking work.	Number of trips needed to deploy and service mooring suites depends on steam time of contracted vessel. Beginning July 2023 and continuing until approval of the RAP.[4]	Boothbay, ME	45-foot (14-meter) research vessel capable of deploying/retrieving sampling equipment at depth.	Acoustic data collected via nine SoundTrap ST600 hydrophones equipped with FPOD devices. Recorded data would be analyzed for all whale calls, especially the presence of North Atlantic right whale calls, with a primary focus on their 100–300-Hertz upcalls. Sound traps would sample at a rate of 48 kHz (24-kHz effective analysis range). FPODs enable detection of odontocete (toothed whale) species with core detection bands generally under 140 kHz.
Motus Tracking	Motus is an international collaborative network established by researchers that has tagged birds and bats with automated radio telemetry tags. A Motus Wildlife Tracking System-compatible receiver station would be deployed on the FLiDAR buoy by PTOW to provide data on the occurrence of tagged birds or bats in the Research Lease Area coupled with information on the season, time of day, and weather conditions. The receiving station would operate at a common frequency compatible with other Motus installations in the region.	Expected to require 2 trips, conducted as part of FLiDAR buoy deployment and decommissioning. 24-month deployment (March 2024 through February 2026).	Portland, ME	See FLiDAR buoy-based acoustic monitoring.	Motus Wildlife Tracking System-compatible receiver station.

Survey or Monitoring Activity	Description	Activity Frequency and Timing	Port	Vessel Type	Equipment or Method
Active Acoustic Surveys and Environmental DNA (eDNA) Sampling of Marine Fish and Invertebrates	Gulf of Maine Research Institute would conduct active acoustic surveys along fixed transects in the Research Lease Area and vicinity to evaluate marine fish, particularly small pelagics, and invertebrate species and taxon abundance and distribution in the water column and in proximity to the benthos.	One 12-hour vessel trip per month. Beginning in September 2022 and continuing until approval of the RAP.[4]	Portland, ME	RV Merlin, a 37-foot (11-meter) converted offshore tuna harpoon vessel.	Simrad EK60 echosounder system with three split-beam transducers (38, 120, and 200 kHz). Water samples collected with a General Oceanics Niskin Water Sampler and run through eDNA analysis would be used to field verify the acoustic data.
Passive Acoustic Monitoring of Large Pelagic and Benthic Fish	DMR opportunistically tags fish with passive acoustic tags to characterize seasonal distribution, movement patterns, and habitat use of highly migratory (e.g., tuna, sharks) and benthic (e.g., cod, hake, haddock, redfish, dogfish) fishes. Pop-up satellite archival tags may be used in future years for longer-range monitoring of larger species such as basking sharks. Receivers capable of detecting the presence of tagged fish would be deployed in a grid across the Research Lease Area with a few additional receivers placed adjacent to the Research Lease Area in areas of high species abundance.	The number of trips would depend on the contracted vessel, port location, and number of tags or receivers deployed per trip. Beginning in Quarter 3 of 2022 and continuing until approval of the RAP.[4]	Undetermined. Portland, ME assumed for analysis.	45-foot (14-meter) research vessel capable of deploying/retrieving sampling equipment at depth.	15 VEMCO VR2AR Receivers would be moored with custom weights and floated approximately 50 feet (15 meters) above the seafloor to detect tags. Each receiver would be equipped with an acoustic release, eliminating the use of vertical lines that may pose risks to marine mammals and turtles. Pop-up satellite archival tags do not require detection by the acoustic array and would pass data via a satellite link at a pre-selected time.

Survey or Monitoring Activity	Description	Activity Frequency and Timing	Port	Vessel Type	Equipment or Method
Bottom Trawl Surveys for Marine Fish and Invertebrates	DMR would conduct bottom trawl surveys to evaluate marine fish and invertebrate species composition in proximity to the benthos. Each season, 30–38 tows would be conducted within and up to 12 nm (22 km) outside of the Research Lease Area. Surveys would not be conducted under regular commercial fishing.	1–6 vessel trips per season depending on steam time, port location, and ability of contracted vessel to overnight offshore. Beginning as soon as September 2023 and continuing for 2 years, or until approval of the RAP.[4]	Boothbay, ME	70-foot (21-meter) stern rigged single screw bottom trawler.	Protocols and equipment would be consistent with those used for the Maine-New Hampshire Inshore Trawl Survey for sorting, weighing, and measuring protocols. Net metric data would be collected at each tow to ensure the net is fishing comparably at each location. Survey equipment would consist of a 57–70-foot (17–21-meter) modified shrimp trawl net with Thyborøn™ type 25 THYson trawl doors approximately 21 ft^2 (2 m^2) in size, weighing 606 pounds (275 kg) each, and towed at a speed of 2.9 mph (4.6 kph or 2.5 knots).
Plankton and Larval Lobster Surveys	DMR would conduct vertical and neuston tows to characterize the zooplankton community, examine aggregation patterns throughout the water column, and quantify abundance and seasonal timing of lobster and other crustacean larvae. Tows would be conducted within and up to 3 nm (5.6 km) outside of the Research Lease Area. Surveys would not be conducted under regular commercial fishing.	During the first year after lease issuance, 1 or 2 vessel trips per month. In subsequent years, the port and number of trips per month would depend on contracted vessel. Beginning in July 2023 and continuing until approval of the RAP.[4]	Boothbay, ME	45-foot (14-meter) research vessel capable of deploying/retrieving sampling equipment at depth.	Vertical tows would follow Fisheries and Oceans Canada's Atlantic Zone Monitoring Program protocols. Neuston tows would follow DMR's larval survey protocol. Selection of survey locations would consider seasonal wind patterns in order to establish a baseline to examine potential impacts on stratification downstream from potential future turbine installations.

Survey or Monitoring Activity	Description	Activity Frequency and Timing	Port	Vessel Type	Equipment or Method
Lobster Trawl Surveys	DMR would conduct lobster surveys to characterize the lobster population, including the presence of large egg-bearing and oversized lobsters, to assess movement patterns of lobsters, and to test ropeless fishing gear. Traps would be set within and up to 12 nm (22 km) outside the Research Lease Area and hauled three times per quarter. Surveys would not be conducted under regular commercial fishing.	Six trips by 12-hour vessel per quarter. Beginning as soon as September 2023 and continuing for 2 years, or until approval of the RAP.[4]	Bristol, ME	50-foot (15-meter) commercial lobster boat, single screw.	Trawls would be equipped with 12 traps, alternating vented and ventless, and would be set with one regular endline and one ropeless fishing unit. The exact gear specifications would be determined based on conversations with industry members.
Gillnet Surveys	PTOW would conduct gillnet surveys to sample fish populations. Each season, 20–30 trawls would be conducted within and around the Research Lease Area. Surveys would not be conducted under regular commercial fishing.	6 vessel trips per quarter. September 2023 through September 2025.	Portland, ME	50–75-foot (15–21-meter) single screw commercial fishing vessel.	The gillnet survey may be conducted using gillnets that are typical of the commercial fishery in Maine. Each gillnet string would consist of six 300-foot (91-meter) net panels of 12-inch (30-centimeter) mesh with a hanging ratio of 1/2 (50 percent) and using net tie-downs.[6]

Sources: DMR, 2023a; Stantec, 2023.

[1] Avian and bat acoustic detectors, as well as a marine mammal hydrophone and fish detection system, would be installed on the FLiDAR buoy prior to deployment. The acoustic detectors and hydrophone will collect data on species (or species group) occurrence. It is currently anticipated that the avian and bat acoustic detectors would be Wildlife Acoustics SM4 units, a SonoVault hydrophone would be used for acoustic monitoring of marine mammal vocalizations, and a VEMCO Positioning system would be used to monitor fish.

[2] All vessels would have protected species observers onboard to monitor for impacts on marine mammals and wildlife.

[3] Avian and bat acoustic detectors may be installed on survey vessels to opportunistically collect seasonal bat activity data within the G&G survey areas, including species occurrence, timing of occurrence, and weather conditions (as recorded by instrumentation on the vessel) at the time of recording. The detectors would be powered by internal batteries and mounted as high as possible on the exterior shipboard side of each vessel's upper deck to enhance bat activity detection and minimize exposure to saltwater and acoustic interference from wave action and other ship operations. It is currently anticipated that the avian and bat acoustic detectors would be Wildlife Acoustics SM4 units.

[4] This EA makes the conservative assumption that the RAP would be approved within 5 years of lease issuance, or approximately September 2028.

[5] Installation of shore-based radar stations would occur independent from the Proposed Action. Potential effects of these onshore activities are not analyzed in this EA.
[6] After discussion with interested parties, a decision was made to limit the gillnet survey to a single mesh size of 12 inches (30 centimeters) to target monkfish and skates of commercial sizes. While it was recognized that deploying experimental gillnets with multiple mesh sizes could potentially sample a wider range of species and size classes, this would also necessitate deploying more strings of gillnets, which could increase the potential for interactions with protected species. The standard soak time of approximately 48 hours is proposed based on input from the industry to maximize catch and standardize catch rates while also ensuring the gear fishes properly during the soak (i.e., not collapsed from saturation), to minimize depredation of catch, and to improve the logistics of the survey. Soak time would remain consistent throughout the duration of the survey, to the extent practicable. Fishable gillnet lines will be determined through consultation with the participating fishermen. Ten to fifteen gillnet lines per area will be randomly selected for each sampling event, resulting in 20 to 30 gillnet strings conducted per sampling event. The sample size, location, and timing of sampling events are subject to change to reduce the potential for interactions with protected species and avoid space-use conflicts with active fisheries.
DMR = Maine Department of Marine Resources; FLiDAR = floating light detection and ranging; ft^2 = square foot; kg = kilogram; kHz = kilohertz; km = kilometer; kph = kilometers per hour; m^2 = square meter; MA = Massachusetts, ME = Maine; mph = miles per hour; nm = nautical mile; PTOW = Pine Tree Offshore Wind

Table 2-2. Anticipated permits and authorizations for site assessment and characterization activities

Agency	Permit or Authorization	Survey or Monitoring Activity
USACE	Preconstruction Notification for Nationwide Permit	FLiDAR buoy, high-resolution geophysical surveys, geotechnical surveys, benthic surveys
USCG	Private Aids to Navigation (PATON)	FLiDAR buoy
NMFS	Incidental Harassment Authorization	High-resolution geophysical surveys, geotechnical surveys, benthic surveys
NMFS	Exempted Fishing Permit	Gillnet surveys
Federal Communications Commissions	Radar License (through Woods Hole Oceanographic Institute)	Physical oceanographic monitoring
Maine Bureau of Parks and Lands	Special Activities Permit	Physical oceanographic monitoring
Maine Department of Marine Resources	Maine Special License	Bottom trawl surveys, lobster trawl surveys

FLiDAR = floating light detection and ranging

2.2.2 Non-Routine Events

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

2.2.2.1 Storms

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

2.2.2.2 Allisions and Collisions

An allision occurs when a moving object (i.e., a vessel) strikes a stationary object (e.g., FLiDAR buoy); a collision occurs when two moving objects strike each other. The presence of the FLiDAR buoy in the Research Lease Area could pose a risk to vessel navigation. An allision between a vessel and the FLiDAR buoy could result in the damage or loss of the buoy and/or the vessel, as well as loss of life and spillage of petroleum product. Vessels conducting site assessment and site characterization activities could collide with other vessels, resulting in damages, petroleum product spills, or capsizing. Collisions between vessels and allisions between vessels and the FLiDAR buoy are considered unlikely because vessel traffic is subject to USCG Navigation Rules and Regulations and controlled by multiple routing measures, such as safety fairways, TSSs, and anchorages for vessels transiting into and out of the ports of Maine and the other New England states. Risk of allisions with the FLiDAR buoy would be further reduced by USCG-required marking and lighting.

As explained in BOEM's decision memorandum regarding the RFCI on August 17, 2022, in order to minimize the potential for conflicts identified by USCG in locating Maine's proposed project in proximity to the existing TSS (shown on **Figure 2-1**), BOEM will consider issuance of no more than one lease within the Research Lease Area, and that lease will neither exceed 10,000 acres (40 km^2) nor support more than 12 floating wind turbine generators. BOEM also expanded the RFCI or Research Lease Area beyond the preferred location (referred to as the Narrowed Area of Interest) identified in the State of Maine's request for the research lease to provide more siting options should the preferred location be determined unsuitable. These measures are anticipated to minimize the potential for conflicts during all stages of the project, including site assessment and site characterization activities, which would result in only a temporary and negligible increase in vessel traffic in proximity to the TSSs.

BOEM anticipates that aerial surveys would not be conducted during periods of storm activity because the reduced visibility conditions would not meet visibility requirements for conducting the surveys; flying at low elevations would pose a safety risk during storms and times of low visibility.

2.2.2.3 Spills

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

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

Vessels are expected to comply with USCG requirements relating to prevention and control of oil spills. Solar panels would be the primary source of power for equipment on the FLiDAR buoy, with backup energy supplied by methanol fuel cells in the hull, which would minimize the volume of oil and fuel that could be released in the event of a spill. BOEM expects that each of the vessels involved with site assessment and site characterization activities would minimize the potential for a release of oils and/or chemicals in accordance with 33 Code of Federal Regulations (CFR) Part 151, 33 CFR Part 154, and 33 CFR Part 155, which contain guidelines for implementation and enforcement of vessel response plans, facility response plans, and shipboard oil pollution emergency plans. Based on the size of the spill, it would be expected to dissipate very rapidly and would then evaporate and biodegrade within a day or two (at most), limiting the potential impacts to a localized area for a short duration.

2.2.2.4 Recovery of Lost Survey Equipment

Equipment used during site assessment and site characterization activities could be accidentally lost during survey operations. Additionally, it is possible (though unlikely) that the FLiDAR buoy could disconnect from its anchor. In the event of lost equipment, recovery operations may be undertaken to retrieve the equipment. Recovery operations may be performed in a variety of ways depending on the equipment lost. A commonly used method for retrieval of lost equipment on the seafloor is through dragging grapnel lines (e.g., hooks, trawls). A single vessel deploys a grapnel line to the seafloor and drags it along the bottom until it catches the lost equipment, which is then brought to the surface for recovery. This process can result in significant bottom disturbances, as it requires dragging the grapnel line along the bottom until it hooks the lost equipment, which may require multiple passes in a given area. In addition to dragging a grapnel line along the bottom, after the line catches the lost equipment, it would drag all the components along the seafloor until recovery.

Marine debris, such as lost survey equipment, that cannot be retrieved because it is either small or buoyant enough to be carried away by currents or is completely or partially embedded in the seafloor (for example, a broken vibracore rod) could create a potential hazard for bottom-tending fishing gear or cause additional bottom disturbance. Various equipment may be deployed to recover marine debris such as cranes, air bags, other mechanical lifts, or remotely operated vehicles. A broken vibracore rod that cannot be retrieved may need to be cut and capped 1 to 2 meters below the seafloor. Lease stipulations listed in Appendix D would require any lost survey gear to be reported and recovered according to BOEM and BSEE Marine Debris Elimination and Reporting requirements. All lost gear must also be reported to the NMFS Greater Atlantic Regional Fisheries Office, Protected Resources Division within 24 hours of the documented time when gear is discovered to be missing or lost (Appendix D). For marine debris unable to be recovered within 48 hours, the lessee would be required to develop a recovery plan and submit to the Department of the Interior for review as specified in Appendix A of the NMFS biological assessment (BA) (BOEM, 2023b). Selection of a mitigation strategy would depend on the nature of the lost equipment, and further consultation may be necessary.

Other impacts associated with recovery of marine debris such as lost survey equipment may include vessel traffic, noise and lighting, air emissions, and routine vessel discharges from typically a single vessel and associated equipment.

3 Affected Environment and Environmental Consequences

3.1 Introduction

3.1.1 Geographic Analysis Areas

BOEM delineated two geographic analysis areas (GAAs) as depicted on **Figure 3-1**:

- **Proposed Action Activity Area:** This area serves as the GAA to evaluate impacts from the Proposed Action for resources that are fixed in nature (i.e., their location is stationary such as benthic and archaeological resources), or for resources where impacts from the Proposed Action would only occur in waters in and directly around the Research Lease Area, other survey areas between the Research Lease Area and shoreline, and areas where vessels and aircraft conducting Proposed Action activities may transit to and from.
- **Gulf of Maine:** This broader area serves as the GAA to evaluate impacts for resources and uses that are highly mobile (e.g., marine mammals, sea turtles, commercial fishing). It encompasses three Ecological Production Units (Georges Bank, Western-Central Gulf of Maine [or Gulf of Maine], and Scotian Shelf-Eastern Gulf of Maine) and extends to the shoreline of the Atlantic coast of the United States. Ecosystem Production Units are defined by NMFS in partnership with the Northeast Fisheries Science Center and represent major areas within bioregions that contain a reasonably well-defined food web/production system. Note that some sections include broad discussion of resources and impacts within the Gulf of Maine for context as well as more specific discussion of the Proposed Action Activity Area.

Table 3-1 identifies GAAs for each resource analyzed in this section.

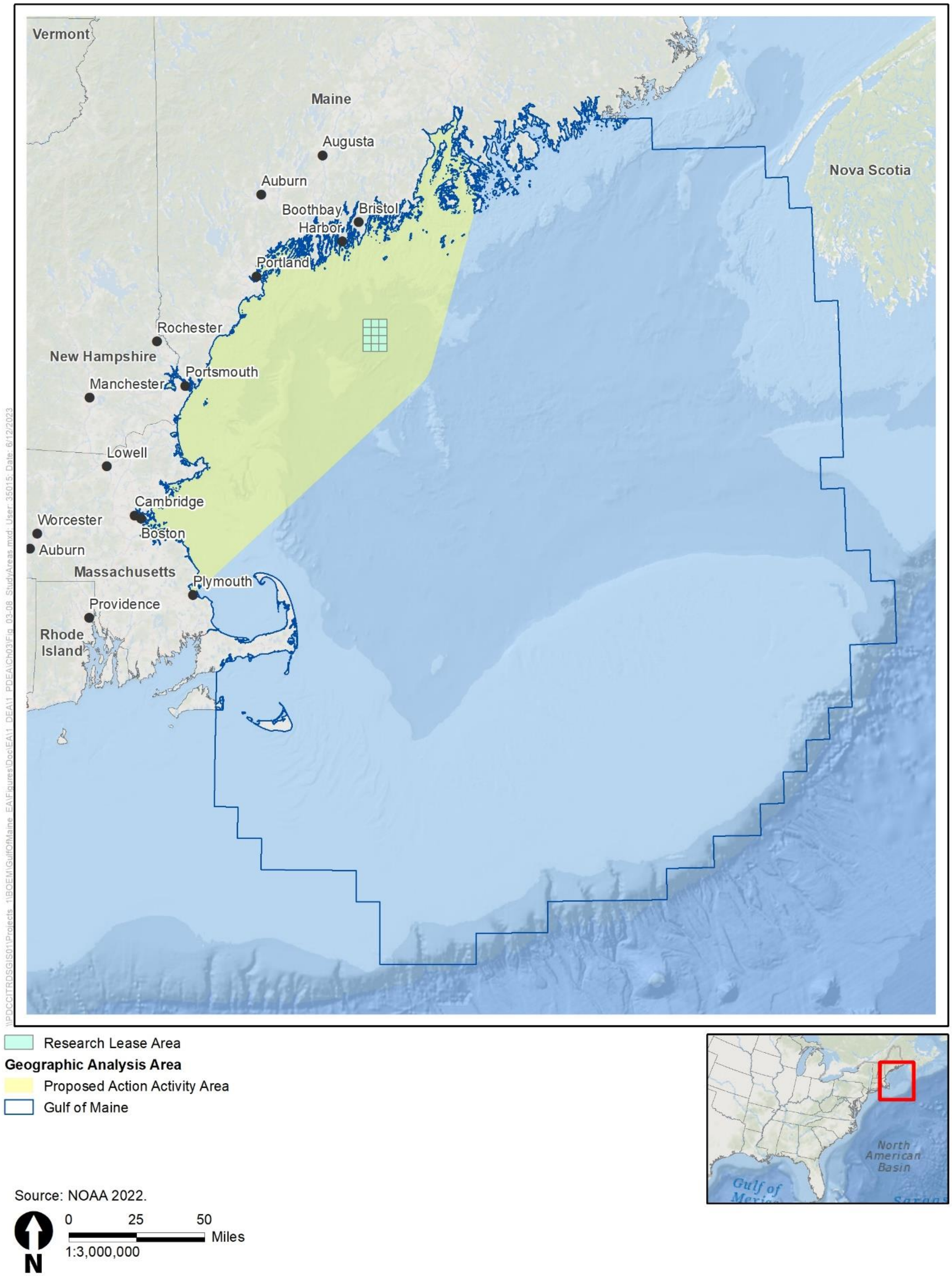

Figure 3-1. Geographic analysis areas

The temporal scope of analysis is the start of site assessment and site characterization activities related to the Proposed Action that began in September 2022 and may continue until September 2028, assuming that a RAP would be approved within 5 years of lease issuance.

Table 3-1. Geographic analysis areas

Resource	Geographic Analysis Area	Rationale
Air Quality and Greenhouse Gas Emissions	Proposed Action Activity Area	This encompasses the area in which emissions from vessels could occur, including the Research Lease Area and extending to the ports at which vessel trips may originate and to the airports from which aircraft trips may originate.
Water Quality	Proposed Action Activity Area	This encompasses the area in which discharges from vessels and small disturbances of seafloor sediment from sampling, trawling, and anchoring could occur, including the Research Lease Area and extending to the ports at which vessel trips may originate.
Benthic Resources	Proposed Action Activity Area	This encompasses the area in which small disturbances of seafloor sediment from sampling, trawling, and anchoring could occur, including the Research Lease Area and potential benthic survey areas between the Research Lease Area and shoreline.
Finfish, Invertebrates, and Essential Fish Habitat	Proposed Action Activity Area	This encompasses most of the EFH important to managed finfish and invertebrate species that might utilize or migrate through the proposed Research Lease Area and other areas of survey activity and vessel traffic between the Research Lease Area and shoreline.
Marine Mammals	Gulf of Maine	Marine mammals will utilize different bathymetric features for various biologically important functions seasonally and year-round. This will account for their highly mobile nature when utilizing habitat in the vicinity of the Research Lease Area and other areas of survey activity and vessel traffic between the Research Lease Area and shoreline.
Sea Turtles	Gulf of Maine	This area will account for the highly mobile nature of sea turtles when utilizing habitat in the vicinity of the Research Lease Area and other areas of survey activity and vessel traffic between the Research Lease Area and shoreline.
Military Use	Proposed Action Activity Area	This allows for a comprehensive evaluation of potential space-use conflicts of the Proposed Action with military uses within the Research Lease Area and transit corridors to and from ports.
Navigation and Vessel Traffic	Proposed Action Activity Area	This allows for a comprehensive evaluation of potential space-use conflicts of the Proposed Action with all commercial vessel traffic within the Research Lease Area, other areas of survey activity and vessel traffic between the Research Lease Area and shoreline, and transit corridors to and from ports.

Resource	Geographic Analysis Area	Rationale
Commercial and Recreational Fishing	Gulf of Maine	This allows for a comprehensive evaluation of potential space-use conflicts of the Proposed Action with all commercial and recreational fishing traffic within the Research Lease Area and transit corridors to and from ports, as well as all areas of potential effects on fish and shellfish species.
Recreation and Tourism	Proposed Action Activity Area	This allows for a comprehensive evaluation of potential space-use conflicts of the Proposed Action with recreation and tourism activities within the Research Lease Area, other areas of survey activity and vessel traffic between the Research Lease Area and shoreline, and transit corridors to and from ports.
Cultural, Historical, and Archaeological Resources	Proposed Action Activity Area	This encompasses the area in which small benthic disturbances from sampling, trawling, and anchoring could occur, as well as onshore historic properties from which vessels or buoy lighting may be visible.

EFH = essential fish habitat

3.1.2 Impact-Producing Factors

This EA analyzes the effects of routine activities associated with site assessment and site characterization activities presented in **Table 2-1**. It does not consider construction and operation of any wind energy facilities on the research lease, which would be evaluated separately if a lessee submits a RAP. **Table 3-2** identifies the primary impact-producing factors (IPFs) associated with the various activities in the Proposed Action that could affect resources.

Table 3-2. Impact-producing factors

IPF	Sources and Activities	Description
Air emissions	• Combustion-related mobile emission sources (e.g., vessels and aircraft)	Refers to emissions from sources that emit regulated air pollutants (gaseous or particulate matter) into the atmosphere.
Noise	• Aircraft • Vessels • G&G and benthic survey equipment	Refers primarily to underwater noise associated with high-resolution geophysical and benthic survey equipment (e.g., multibeam echosounder, side-scan sonar, sub-bottom profiler, and magnetometer), geotechnical and benthic sampling, and engines of vessels conducting site assessment and site characterization activities. Underwater noise may be pulsed at specific frequencies (e.g., active acoustic survey equipment) or broad spectrum and continuous (e.g., from project-associated marine transportation vessels). Vessels and aircraft conducting site assessment and site characterization activities would also contribute to noise above the ocean surface.

IPF	Sources and Activities	Description
Lighting	• FLiDAR buoy • Vessels	Refers to safety and navigational lighting on the FLiDAR buoy and on vessels operating at nighttime.
Seafloor disturbance	• FLiDAR buoy deployment and removal (i.e., decommissioning) • Vessel anchoring • Geotechnical and benthic sampling	Refers to any seafloor disturbance from FLiDAR buoy deployment and removal and vessels conducting site assessment and site characterization activities, as well as seafloor disturbance from geotechnical activities (e.g., geotechnical coring and cone penetration testing) and benthic sampling (e.g., benthic grab).
Entanglement	• FLiDAR buoy anchor line • Vessel anchor lines • Fishing survey gear	Refers to any possible entanglement (either marine species or other vessels) due to anchoring lines from vessels or the FLiDAR buoy or entanglement in fishing gear (e.g., trawl nets, traps) deployed by fishing vessels engaged in biological site characterization activities.
Routine vessel discharges	• Vessels	Refers to potential discharges of uncontaminated water from vessels engaged in site assessment and site characterization activities. These discharges may include uncontaminated ballast water and uncontaminated water used for vessel air conditioning or treated liquids from deck drainage and sumps.
Vessel traffic and space-use conflicts	• Vessels	Refers to potential conflicts that could arise when vessels engaged in site assessment and site characterization activities are present in areas where other marine uses, such as commercial and recreational fishing, marine transportation (e.g., commercial shipping), and military use, are also occurring. Also encompasses potential vessel strikes that could injure or kill marine mammals and sea turtles, including protected species.

3.1.3 Impact Definitions

This EA uses a four-level classification scheme (negligible, minor, moderate, and major) defined in **Table 3-3** to characterize the environmental impacts predicted if the Proposed Action or the No Action Alternative is implemented. Definitions of impacts are presented in two separate groups: (1) biological and physical and (2) socioeconomic resources. The impact level definitions below were originally developed for BOEM's *Programmatic Environmental Impact Statement for Alternative Energy Development and Production and Alternate Use of Activities on the Outer Continental Shelf* (MMS, 2007), were used in other previous lease issuance EAs, and are used in this EA to provide consistency in BOEM's discussion of impacts.

Table 3-3. Definitions of impact determinations used in this environmental assessment

Impact Determination	Definition for Biological and Physical Resources	Definition for Socioeconomic Resources
Negligible	Little to no effect or no measurable impacts.	Little to no effect or no measurable impacts.
Minor	Most impacts on the affected resource could be avoided with proper mitigation. Impacts would not disrupt the normal or routine functions of the affected resource. If impacts occur, the affected resource would recover completely without any mitigation once the impacting agent is eliminated.	Adverse impacts on the affected activity or community could be avoided with proper mitigation. Impacts would not disrupt the normal or routine functions of the affected activity or community. Once the impacting agent is eliminated, the affected activity or community would return to a condition with no measurable effects without any mitigation.
Moderate	Impacts on the affected resource are unavoidable. Proper mitigation would reduce impacts substantially during the life of the Proposed Action. The viability of the affected resource is not threatened, although some impacts may be irreversible, or the affected resource would recover completely if proper mitigation is applied during the life of the Proposed Action or proper remedial action is taken once the impacting agent is eliminated.	Impacts on the affected activity or community are unavoidable. Proper mitigation would reduce impacts substantially during the life of the Proposed Action. The affected activity or community would have to adjust somewhat to account for disruptions due to impacts of the Proposed Action, or, once the impacting agent is eliminated, the affected activity or community would return to a condition with no measurable effects if proper remedial action is taken.
Major	Impacts on the affected resource are unavoidable. Proper mitigation would reduce impacts somewhat during the life of the Proposed Action. The viability of the affected resource may be threatened, and the affected resource would not fully recover, or the resource may retain measurable effects indefinitely even if proper mitigation is applied during the life of the Proposed Action or remedial action is taken once the impacting agent is eliminated.	Impacts on the affected activity or community are unavoidable. Proper mitigation would reduce impacts somewhat during the life of the Proposed Action. The affected activity or community would experience unavoidable disruptions to a degree beyond what is normally acceptable, and, once the impacting agent is eliminated, the affected activity or community may retain measurable effects indefinitely, even if remedial action is taken.

3.1.4 Resources Eliminated from Further Consideration

NEPA employs a scoping process to determine which environmental issues warrant analysis in detail and which issues can be eliminated from detailed analysis, thereby narrowing the scope of the EA to those issues most relevant to the decision. Scoping includes both internal scoping with BOEM subject matter experts and cooperating agencies, and public scoping with other interested parties. For reasons described in **Table 3-4**, certain resources will not be carried forward for analysis in this EA because impacts on those resources from the Proposed Action are anticipated to be negligible or lower. However, the resources listed here may be within the scope of analysis for future actions, such as the construction and operation of wind energy-related research facilities.

Table 3-4. Resources eliminated from further consideration

Resource	Rationale for Elimination
Bats	Bat activity in the Atlantic has been found to decline dramatically 11 nm (20.3 km) from shore (Sjollema et al., 2014), and it is generally considered unlikely that any bats would travel 15 nm (27.8 km) or more from land over open water to forage (Peterson, 2016; Sjollema et al., 2014). The nearest shoreline and mainland areas from the Research Lease Area boundary are 19 nm (35.2 km) and 22 nm (40.7 km) away, respectively. Although unlikely to travel such a distance from the mainland, any bats present within the Research Lease Area could have avoidance or attraction responses to the survey vessels and/or buoy due to noise, lighting, and the possible presence of insects. Due to the scarcity of bats offshore in the Research Lease Area, the limited amount of added vessel traffic (relative to existing traffic described in **Section 3.3.8**), and the single buoy to be installed at a distance of approximately 22 nm (40.7 km) or more from shore, collisions between bats and boats/meteorological buoys is unlikely. There may be temporary impacts on bats from operational noise and human activity during survey operations near coastal areas; these operations, however, would be temporary, infrequent, localized around existing ports, and substantially similar to existing vessel traffic and operations. Therefore, the overall impact of activities associated with the Proposed Action would be negligible.
Birds	The Atlantic Coast is a major flyway for birds, including terrestrial species, shorebirds, waterbirds, and marine birds. Eight shorebirds nest in Maine, with three of those bird species having special listing status: the piping plover (federally listed as threatened, state-listed as endangered), upland sandpiper (state-listed as threatened), and American oystercatcher (state species of special concern). An additional 15 special-status birds regularly migrate through Maine (Maine Department of Inland Fisheries and Wildlife, 2023). Impacts could include the effects associated with light, noise (from vessels, aircraft, and equipment), vessel traffic, installation of the FLiDAR buoy, and non-routine events. Relative to existing vessel traffic in the Gulf of Maine, the Proposed Action would introduce a small number of vessels over the timeframe of the Proposed Action, and one buoy would be installed, resulting in negligible impacts on birds. Additionally, lessees would be required to abide by the Maine State Wildlife Action Plan (Maine Department of Inland Fisheries and Wildlife, 2015) to reduce the potential for the Proposed Action to adversely affect this resource.

Resource	Rationale for Elimination
Coastal Habitat	The nearest shoreline from the Research Lease Area boundary is approximately 19 nm (35.2 km) away. Most vessel traffic from site assessment and site characterization activities would be concentrated around this area and would have no direct impacts on coastal habitats. Nearshore vessel traffic for some surveys (e.g., of potential export cable routes and a wet storage area) and transiting to and from ports would be temporary, infrequent, and have minimal potential to affect coastal habitats in already heavily used port areas. No expansion of these ports is expected in support of the Proposed Action and no direct impacts on coastal habitats are anticipated from routine activities associated with site assessment and site characterization activities, or from non-routine events under the Proposed Action. Indirect impacts from routine activities may include wake-induced erosion and increased turbidity caused by nearshore vessel traffic but would be negligible or lower given the small amount of added vessel traffic to existing traffic in the area.
Coastal Infrastructure	Existing commercial ports, harbors, or industrial areas composing the coastal infrastructure would be used for the Proposed Action, primarily for loading and unloading equipment from vessels and vessel moorage and passage. Activities associated with the Proposed Action would not require additional coastal infrastructure to be constructed or expansion of existing ports. There would be no impacts on coastal infrastructure because the existing infrastructure and facilities would be adequate to accommodate Proposed Action activities.
Demographics and Employment	Temporary increases in employment from Proposed Action activities, such as surveying and FLiDAR buoy fabrication and installation, could occur in various local economies associated with onshore- and offshore-related industry in the Gulf of Maine. However, the small number of workers directly employed for site assessment and site characterization activities would not have a perceptible impact on local employment and demographic characteristics, such as population. Additionally, many site characterization surveys are likely to be conducted by contracted commercial fishing vessels and crews, which may result in economic benefits to local business and income, but are unlikely to generate additional long-term employment opportunities. BOEM expects any beneficial impacts on employment, population, and the local economies in and around the port to be short term and imperceptible; therefore, impacts would be negligible.
Environmental Justice	Based on the distance of the nearest shoreline from the Research Lease Area boundary (19 nm or 35.2 km) and the negligible impacts of the Proposed Action on demographics and employment (see previous row), the site assessment and site characterization activities would not result in disproportionate and adverse environmental or health effects on minority or low-income populations. Only the use of existing coastal facilities has the potential to affect minority or low-income populations. However, existing coastal facilities in the Gulf of Maine would support proposed activities without any need for expansion. There would be no impacts on environmental justice because disproportionately high and adverse human health or environmental effects that would disproportionately affect low-income and minority persons would not occur as a result of the Proposed Action.

Resource	Rationale for Elimination
Visual Resources	The potential impacts on visual resources associated with site assessment and site characterization activities would be negligible. The Research Lease Area boundary is approximately 19 nm (35.2 km) from the nearest shoreline, and the FLiDAR buoy, which would be the only continuously moored equipment, would not be distinguishable from a vessel at those distances because it would sit only a few meters above the waterline. Given the distance of the Research Lease Area from shore, the fact that no new coastal infrastructure would be necessary, and the relatively small amount of vessel traffic associated with the Proposed Action, visual impacts on onshore cultural resources and recreation and tourism would be limited and temporary in nature and would most likely not be distinguishable from existing vessel traffic. Therefore, impacts on visual resources would be negligible.

km =kilometer; nm = nautical mile

3.2 Affected Environment

This section establishes the baseline (or existing) condition of affected resources.

3.2.1 Regional Overview

The Gulf of Maine is a semi-enclosed sea in the Atlantic Ocean, bordered by the coastlines of Massachusetts, New Hampshire, Maine, New Brunswick, and Nova Scotia. It is an ecologically diverse region with unique benthic features and oceanographic circulation patterns that contribute to flourishing and productive marine resources, which in turn support culturally significant fisheries and recreational activities. The complex geomorphology made up of deep basins and shallow banks, oceanographic circulation influenced by the Labrador Current and the Gulf Stream, and a diverse benthic habitat make the Gulf of Maine one of the most productive and ecologically important marine environments in the North Atlantic.

Due to the interconnected nature of the geomorphological, biological, and social aspects of the Gulf of Maine, BOEM is planning on adopting an ecosystem-based management (EBM) approach that considers the ecosystem as a whole in the cumulative impacts analysis, as further described in **Section 4.1**. The resource areas are described and analyzed individually in **Section 3.2** and **Section 3.3** to provide a full evaluation of the resource prior to evaluation at the ecosystem level in the cumulative impacts analysis. The individual resource area sections below begin with a description of the physical environment of air quality and water quality, followed by a description of the biological environment from the benthic communities to the apex predators. The human dimension is then discussed including marine uses such as military use areas and marine transportation, commercial and recreational fishing, recreation and tourism, and culturally important areas.

3.2.2 Air Quality and Greenhouse Gas Emissions

Air quality is characterized by comparing the ambient air concentrations of criteria pollutants to the National Ambient Air Quality Standards (NAAQS), which have been established by the U.S. Environmental Protection Agency (EPA) to be protective of human health and welfare. The NAAQS have been established in 40 CFR 50 for each of the six criteria pollutants: sulfur dioxide (SO_2), nitrogen dioxide

(NO_2), carbon monoxide (CO), ozone (O_3), particulate matter (PM10 and PM2.5, particulate matter with a diameter less than or equal to 10 and 2.5 micrometers, respectively), and lead. O_3 is not emitted directly but forms in the atmosphere from precursor pollutants such as nitrogen oxides (NO_X) and volatile organic compounds (VOCs).

When the monitored pollutant levels in an area exceed the NAAQS for any pollutant, EPA designates the area is classified as "nonattainment" for that pollutant. The coastal counties in Massachusetts, New Hampshire, and Maine nearest the Research Lease Area include:

- Plymouth, Norfolk, Suffolk, Middlesex, and Essex in Massachusetts
- Rockingham and Strafford in New Hampshire
- York, Cumberland, Androscoggin, Sagadahoc, Lincoln, and Kennebec in Maine

All these counties are in attainment with the NAAQS, i.e., pollutant levels are less than the standards, for each of the six criteria pollutants (EPA, 2023).

Section 162(a) of the Clean Air Act establishes air quality protections for designated federal Class I areas such as national parks, national wilderness areas, and national monuments. The Class I area closest to the Research Lease Area is Acadia National Park, which is approximately 55 miles (88 kilometers [km]) from the Research Lease Area. Federal land managers must be notified of facilities that will be within 62 miles (100 km) of a Class I area. It is not anticipated that activities in or near the Research Lease Area would affect visibility in Acadia National Park.

Climate change is a global issue that results from the increase in greenhouse gases (GHGs) in the atmosphere. The Intergovernmental Panel on Climate Change released a special report in October 2018 that assessed the risks and impacts associated with an increase of global warming of 1.5 degrees Celsius (°C) and also compared these to an increase of 2°C (IPCC, 2018). The report found that climate-related risks depend on the rate, peak, and duration of global warming, and that an increase of 2°C was associated with greater risks associated with climatic changes, such as extreme weather and drought; global sea level rise; impacts on terrestrial ecosystems; impacts on marine biodiversity, fisheries, and ecosystems and their functions and services to humans; and impacts on health, livelihoods, food security, water supply, and economic growth.

The most recent available data on GHG emissions in the U.S. indicate that annual emissions in 2020 were an estimated 5,981,400,000 metric tons (EPA, 2022b). Additional information about the impacts of climate change is presented in **Appendix C, Section C.2.7**.

3.2.3 Water Quality

Water quality in the Gulf of Maine is affected by contaminants entering the marine environment through a variety of sources, including point source and non-point source discharges. Water quality is generally good in most coastal and marine waters of Maine due to mixing action from large tides; however, waters with less limited tidal mixing, shallow depths and naturally warmer water, and receiving contaminated runoff and discharges are more vulnerable to degradation.

The Maine Department of Environmental Protection, Marine Environmental Monitoring Program was established in 1991 to monitor the "extent and effect of industrial contaminants and pollutants on marine and estuarine ecosystems and to determine compliance with and attainment of water quality standards" (38 Maine Revised Statutes 410-F). The State has three water quality classes that establish goals for and direct management of marine and estuarine waters—SA, SB, and SC—listed in order from the highest-quality goal and most resiliency to degradation to the lowest-quality goal and least resiliency to degradation (38 Maine Revised Statutes 465-B). Based on monitoring of ambient water quality, nutrients, and eutrophication indicators, the majority of marine and coastal waters are classified as SB, with waters intermittently classified as SA (highest-quality goal) along less-developed portions of the Gulf of Maine coastline and islands, and localized areas at the outlets of industrialized or nutrient-rich watersheds classified as SC (lowest-quality goal) (Maine Department of Environmental Protection, 2023). In accordance with Section 305(b) of the Clean Water Act, the Maine Department of Environment Protection also assesses the condition of water bodies in Maine and assigns each to one of five categories, different from water quality classes described above, based on the most recent available water quality data. Category 1 represents waters attaining all designated uses and Category 5 represents waters listed as impaired or threatened under Section 303(b) requiring development of a Total Maximum Daily Load calculation to determine pollution reduction targets. Based on monitoring data collected in calendar years 2013 through 2020 and presented in the 2018/2020/2022 Integrated Report, the Maine Department of Environment Protection categorized the majority of estuarine and marine waters as Class II: attaining some designated uses, and insufficient or no data to determine if remaining uses are attained (with the presumption that all uses are attained) (Maine Department of Environmental Protection, 2022). The Class II estuarine and marine waters include 86.4 percent of 2,884 square miles (7,470 km^2) assessed that are designated for shellfish harvest, 99.5 percent of 2,889 square miles (7,482 km^2) assessed that are designated for all other uses, and 99 percent of 39 miles (63 km) assessed that are coastal designated beaches. Only 1.3 percent of shellfish harvest waters, 0.3 percent of all other use waters, and 2 percent of coastal designated beaches were classified as impaired or threatened (Category 5) (Maine Department of Environmental Protection, 2022).

The Gulf of Maine has experienced rapid increases in sea surface temperatures greater than much of the global ocean, likely due to increased atmospheric GHG concentrations and changes in western North Atlantic circulation (Whitney et al., 2022). Water quality in the Gulf of Maine is influenced by other compounding effects of global climate change, such as increased salinity and acidification, as summarized in **Appendix C**, **Section C.2.7**.

3.2.4 Benthic Resources

The Gulf of Maine is among the most diverse and productive temperate marine environments in the world (Greene et al., 2010). Covering a wide geographical range from Cape Cod Bay in Massachusetts all the way north to the Canadian border and the Bay of Fundy, the Gulf of Maine contains many unique features. The Gulf of Maine is partitioned into several regions, distinguished by depth, geologic features, and oceanographic patterns. The Bay of Fundy in the very northern region is known to have the highest tidal flux worldwide, ranging up to a maximum mean height of 52 feet (16 meters) in the inner reaches of the bay (East Coast Aquatics, 2011), while the southern region including Georges Bank has the highest fish diversity and is one of the most productive fishing areas in the northwest Atlantic Ocean (Incze et al., 2010). Other named features include Cashes Ledge, Jefferys Ledge, Wilkinson Basin, Jordan Basin, and Platt's Bank (Pentony, 2022). The Gulf of Maine consists of numerous deep basins, deep channels, and shallow banks as remnants from glacial deposition and erosion. These deep-channel habitats include the Northeast and Great South Channels. The inflow of water from the Northeast Channel and the outflow of the Great South Channel create a large counter-clockwise eddy (Burgess, 2022). This counter-clockwise gyre meets with the clockwise gyre over Georges Bank and creates among the most variable water temperatures in the North Atlantic Ocean year to year (East Coast Aquatics, 2011). The benthic features enable the flow of colder waters from the north and promote strong stratification patterns. According to the 2023 State of the Ecosystem report, seasonal sea surface temperatures in 2022 were above average throughout the year, with some seasons exceeding the record warm temperatures observed in 2012 (NOAA Fisheries, 2023d). This instability in the Gulf Stream may lead to alterations of biological cycles and seasonal movement patterns (NOAA Fisheries, 2023d).

The affected environment includes the Research Lease Area as well as potential benthic survey areas in nearshore and estuarine waters along the Maine coast between the Research Lease Area and the shoreline. From tidal areas to roughly 9 nautical miles (nm) (16.7 km) at water depths of approximately 295 feet (90 meters) the sediment is rocky with sand and gravel deposits, including the Kennebec paleo-delta. Muddy sediment deposits are also observed over large areas. High-relief features exist beyond 9 nm (16.7 km) (Burgess, 2022). Water within the GAA reaches depths of approximately 5,000 feet (1,524 meters) along the southeastern edge (University of New Hampshire, 2023). The predominant sediment type within the Research Lease Area is silt (0.002–0.06 millimeters). This area is generally flat with depressions and slopes, with water depths ranging from 518–620 feet (158–189 meters) (Pentony, 2022).

The habitats within the Research Lease Area may also support deep-sea corals and sponges. Unlike shallow-water corals, which require sunlight, deep-sea corals and sponges are suspension feeders that rely on planktonic and organic matter to obtain their energy. Octocorals, including sea pens, are common in colder and deeper waters. In 2014, octocoral garden communities were discovered in the northern Gulf of Maine in water depths of 656 to 820 feet (200 to 250 meters) (Auster et al., 2013; Auster et al., 2015; NOAA Fisheries, 2018). Dense aggregations of one or more species of deep-sea octocorals are referred to as coral gardens (Fountain et al., 2019). Many coral species function as ecosystem engineers and provide habitat for many other species, including juvenile fish. Recent surveys allude to the fact that coral presence may be higher than expected, despite benthic disturbance from nearby fishing activities such as bottom trawling and dragging. NOAA's Deep-Sea Coral Research and Technology Program compiles a national database of the known locations of deep-sea corals and sponges in U.S. waters (Deep Sea Coral Research and Technology Program, 2016; Hourigan et al., 2015); however, there is currently no information available on the presence or absence of these features within the Research Lease Area (Pentony, 2022).

The Maine Coastal Mapping Initiative routinely conducts surveys within the Gulf of Maine including Casco Bay, particularly since 2015 (Benson and Enterline, 2021; Dobbs, 2017). The surveys conducted in 2015 and 2016 encompassed or were near to the Research Lease Area (Kennebec paleo-delta) and covered approximately 57 square miles (148 km^2) of the seafloor, along with benthic samples at 54 locations (Dobbs, 2017). Dobbs (2017) found that sand was the most common sediment type found, with 83 percent of the samples containing more than 20 percent sand and 51 percent predominantly sand, according to Folk classifications. The samples nearshore at a depth of 164 feet (50 meters) or fewer generally had the greatest sand concentration (Dobbs, 2017). Gravel-sized particles were also common in the southern and eastern regions of the GAA in depths ranging from 98– 164 feet (30–50 meters) and represented an average of 11 percent by weight in all the samples (Dobbs, 2017).

There are approximately 2,645 invertebrate species in the Gulf of Maine (Incze et al., 2010), including managed invertebrate species such as American lobster (*Homarus americanus*), northern shortfin and longfin squid (*Illex illecebrosus/Loligo pealeii*), and Atlantic sea scallop (*Placopecten magellanicus*). These marine invertebrates serve a pivotal role in the marine ecosystem, as the base of the ocean food webs, including demersal fish species such as Atlantic cod (*Gadus morhua*), black sea bass (*Centropristis striata*), and summer and winter flounder (*Paralichthys dentatus/Pseudopleuronectes americanus*) (Greene et al., 2010). Nearshore habitats include shallow-water estuaries and bays, which are mostly soft-bottom sediments but also include shellfish beds and submerged aquatic vegetation. These various habitats provide food and shelter for high trophic species and boost local biodiversity while also serving as nursery grounds for local fish species (Kritzer et al., 2016; Stevenson et al., 2014). Stevenson et al. (2014) evaluated the importance of these nearshore habitats for 16 of the most common commercially important species and their prey. Their analysis showed that sand and gravel/cobble habitats are used by the majority of species and life stages, followed by mud, eelgrass, macroalgae, boulder, salt marsh channels, and shell (mussel) beds. Shallow water habitats in the Gulf of Maine provide valuable ecological services for a variety of species. Mud, gravel/cobble, and vegetated habitats are particularly important as juvenile nursery grounds for species such as Atlantic cod, American lobster, winter flounder, soft-shell clams (*Mya arenaria*), and blue mussels (*Mytilus edulis*) (Stevenson et al., 2014). The lobster fishery, dominant in value, license, and impact of Maine coastal communities, generally targets areas of high seafloor complexity and transition habitats or edge environments (Burgess, 2022). Juvenile lobsters are common in shallow waters while adults can be found in habitats as deep as 700 meters, where they are not as dependent on sheltering from predators (Stevenson et al., 2014).

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

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

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

3.2.5 Finfish, Invertebrates, and Essential Fish Habitat

The affected environment encompasses coastal (marine and estuarine) and demersal and pelagic habitats in the open ocean that provide habitat for over 118 finfish families consisting of 252 species (2002). This estimate is limited to a 275-meter (902-foot) bathymetric contour initially set by Bigelow and Schroder (1953). Based on the Census of Marine Life findings, the Gulf of Maine contains approximately 2,645 named invertebrate species (Incze et al., 2010). Many finfish and invertebrate species found in the Gulf of Maine are important due to their value as commercial and recreational fisheries (**Section 3.2.10**). NOAA Fisheries ESA-listed endangered finfish species inhabiting the Gulf of Maine include the Atlantic salmon Gulf of Maine distinct population segment (DPS), shortnose sturgeon, and Gulf of Maine DPS of Atlantic sturgeon.

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

Essential fish habitat (EFH) for fish and shellfish resources of the GAA was characterized using broad ecological/habitat categories: soft bottom, hard bottom, and pelagic. The EFH Assessment prepared in association with this EA lists the life stage composition and distribution within each ecological/habitat category (BOEM, 2023c).

The GAA primarily includes EFH for soft-bottom associated species (Atlantic sea scallop, inshore squids, offshore squids, bluefish, hakes, skates, cod, and flatfishes) and several highly migratory species such as tunas and sharks. Habitat areas of particular concern (HAPCs) (**Figure 3-2**) within the Gulf of Maine include Jeffreys & Stellwagen Bank HAPC, inshore juvenile cod (fewer than 20-meter depths) and summer flounder submerged aquatic vegetation nursery areas. The NOAA-designated HAPC for inshore juvenile cod is at the very southern tip of the GAA (Plymouth, Massachusetts; **Figure 3-2**), although juvenile cod habitat (structurally complex, such as eelgrass, algae, rocky benthic habitat, and contiguous sandy habitats) is found throughout the GAA and supports the Atlantic cod population within the Gulf of Maine. HAPCs for summer flounder include native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations, within adult and juvenile summer flounder EFH. In locations where native species seagrass and macroalgae have been eliminated from an area, exotic aquatic plant species are included (NOAA Fisheries, 2023b). Within the Gulf of Maine and the GAA, New England Fishery Management Council (NEFMC) and NOAA Fisheries have designated multiple Habitat Management Areas (HMAs). The closest HMAs shown on **Figure 3-2** are the Jefferies Bank to the east and Cashes Ledge Groundfish Closure area south of the GAA. As depicted on **Figure 3-2**, the GAA is not within any of thse designated HMAs. The only potential impacts on HMAs would be in the Gulf of Maine Cod Protection Closure areas. The Cod Protection Closure Areas are sectors of the Gulf of Maine that extend to and encompass the coastal and nearshore areas (NOAA Fisheries, 2022b). The areas are closed during various periods throughout the year to support Atlantic cod recovery efforts.

Estuarine (inshore) portions of the GAA are characterized mostly by sedimentary soft-bottom habitat but also support salt marshes, oyster reefs, and mussel beds, as well as stands of eelgrass and kelp beds (Stevenson et al., 2014). Fishes segregate into these habitats by species and life stages. Managed species present in inshore waters include squids, cunner, Tautog, bluefish, summer flounder, and winter flounder (Stevenson et al., 2014). Many of these species are present as juveniles or subadults. Inshore habitats of the region are productive and support common prey species such as shrimps, bay anchovy, Atlantic herring, Atlantic menhaden, butterfish, killifishes, and Atlantic silversides (Lapointe, 2013; Raposa and Schwartz, 2009).

Finfish, invertebrates, and EFH in the Gulf of Maine are subject to pressures from ongoing activities, especially harvest, bycatch, dredging and bottom trawling, and climate change (NOAA Fisheries, Gustavson, 2011; Lapointe, 2013; 2023d). As discussed in **Section 3.2.2**, climate change is also predicted to affect U.S. Northeast fishery species (Hare et al., 2016) and the Gulf of Maine particularly; some stocks may increase habitat and some may see habitat reduced. Dredging for navigation, marine minerals extraction, and/or military uses, as well as commercial fishing using bottom trawls and dredge fishing methods (sea scallops), disturbs seafloor habitat on a recurring basis. Commercial and recreational fishing using other methods results in mortality of finfish and invertebrates through harvest and bycatch. In the most recent ecosystem evaluation for the Gulf of Maine (December 2022), no managed species were reported as overfished (NOAA Fisheries, 2022c).

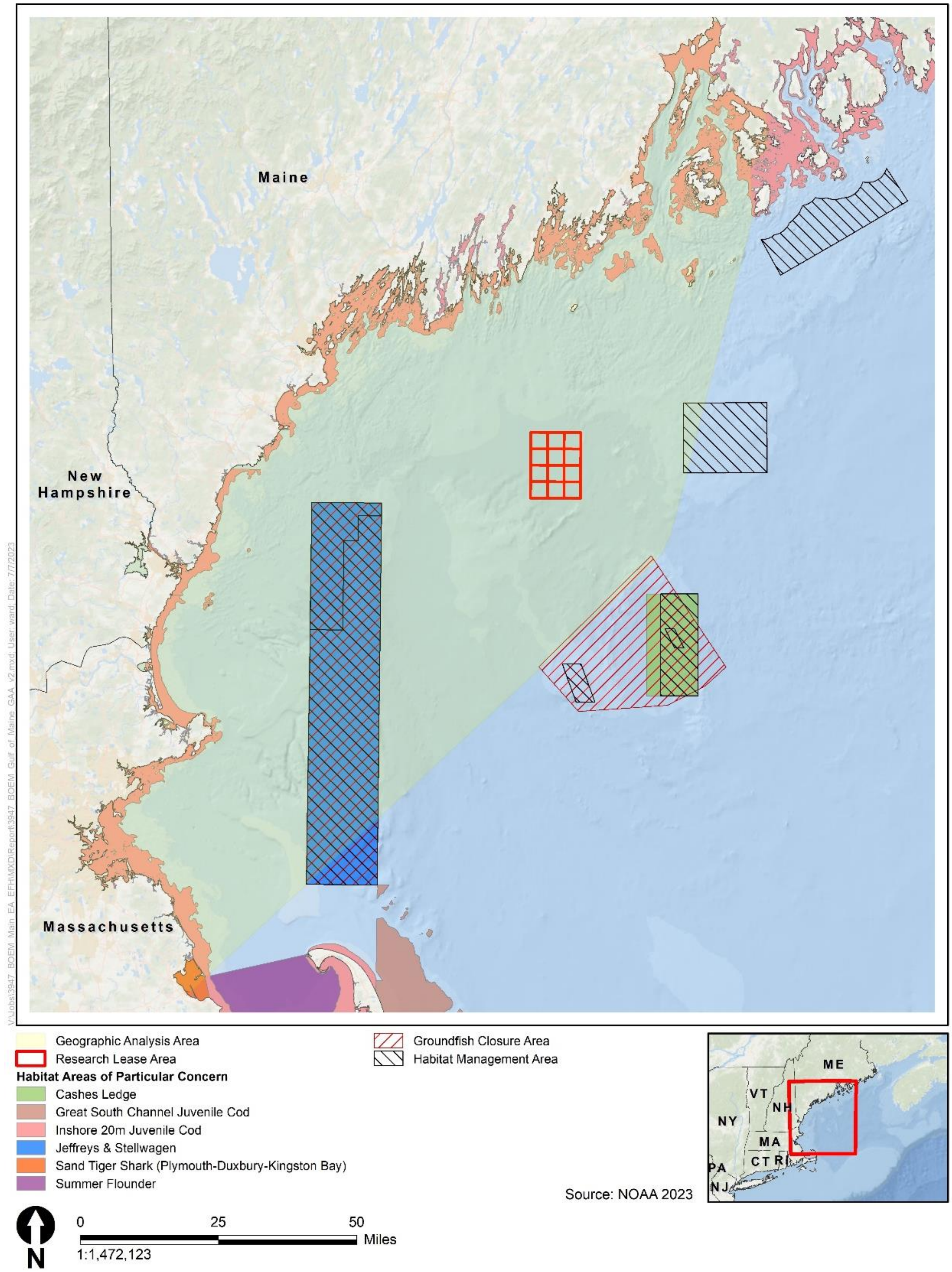

Figure 3-2. Habitat areas of particular concern in the vicinity of the Research Lease Area within the Gulf of Maine

3.2.6 Marine Mammals

There are 30 species of marine mammals that may occur in the Gulf of Maine, consisting of 6 mysticete (baleen whales), 20 odontocete (toothed whales, dolphins, and porpoises), and 4 pinniped (seals) species. Of these species, 14 are considered to occur within the Gulf of Maine in the vicinity of the Proposed Action Activity Area on a common, regular, or uncommon basis; all other species are considered rare (**Table 3-5**). The highest levels of marine mammal biodiversity (i.e., greatest species richness) off the Northeast U.S. occurs in the vicinity of Georges Bank, especially in proximity to the OCS shelf edge and the Northeast Canyons and Seamounts Marine National Monument (Hodge et al., 2022). The majority of marine mammal species identified as “rare” in the vicinity of the Proposed Action Activity Area are more likely to use this shelf break region without predictable occurrences within interior portions of the Gulf of Maine. All 30 species are protected by the Marine Mammal Protection Act; in addition, five marine mammal species are also protected under the ESA. These species are listed as endangered and include the blue whale (*Balaenoptera musculus*), fin whale (*Balaenoptera physalus*), North Atlantic right whale (NARW) (*Eubalaena glacialis*), sei whale (*Balaenoptera borealis*), and sperm whale (*Physeter macrocephalus*).

Occurrence, seasonality, habitat use, and relative densities of the 14 marine mammal species were assessed based on the most current available aerial and vessel survey data, which are routinely collected near the Research Lease Area. Current species or NMFS management stock abundance estimates can be found in annual NMFS marine mammal stock assessment reports (Hayes et al., 2019, 2020; Hayes et al., 2021; Hayes et al., 2022; NMFS, 2023e; Waring et al., 2015). For these reports, data collection, analysis, and interpretation are conducted through marine mammal research programs at NOAA Fisheries Science Centers and by other researchers. Additional population information for the NARW is understood using the North Atlantic Right Whale Consortium’s Annual Report Card (Pettis et al., 2022) and Pace’s 2021 population modeling report.

There are additional sources of data that were used to inform marine mammal occurrence and distribution within the Gulf of Maine. The Atlantic Marine Assessment Program for Protected Species coordinates data collection and analysis to assess the abundance, distribution, ecology, and behavior of marine mammals in the U.S. Atlantic. These include both ship and aerial surveys conducted from 2010 and currently ongoing. Atlantic Marine Assessment Program for Protected Species survey efforts cover a broad area, which encompasses the Gulf of Maine (Palka et al., 2021; Palka et al., 2017). A habitat-based cetacean density model for the U.S. Exclusive Economic Zone of the East Coast (eastern U.S.) and Gulf of Mexico was also developed by the Duke University Marine Geospatial Ecology Lab in 2016 (Roberts et al., 2016). These models have been subsequently updated to include more recently available data in 2017, 2018, 2019, 2020, and 2022 (Curtice et al., 2019; MGEL, 2022; Roberts et al., 2017; Roberts et al., 2018; Roberts et al., 2020). Collectively, these estimates are considered the best information currently available for marine mammal densities in the U.S. Atlantic. Abundance and density data maps for individual species are accessible from Duke University’s Marine Geospatial Ecology Lab online mapper (MGEL, 2022). Other regional data, scientific literature, and technical reports were also used to assess marine mammal distribution patterns in the region.

Table 3-5. Marine mammals that may occur within the Gulf of Maine and in the vicinity of the Proposed Action Activity Area

Common Name	Scientific Name	ESA/MMPA Status[1]	Relative Occurrence in the Proposed Action Activity Area[2]	Seasonal Occurrence in the Proposed Action Activity Area[3]	Critical Habitat in Area of Direct Effects	Stock (NMFS)	Population (Abundance) Estimate[4]	Population Trend[5]	Total Annual Human-Caused Mortality/ Serious Injury (M/SI)[6]	Reference
Mysticetes										
Blue whale	*Balaenoptera musculus*	E/D	Rare	Rare	N/A	Western North Atlantic	402[7]	Unknown	Unknown	Hayes et al. (2020)
Fin whale	*Balaenoptera physalus*	E/D	Common	Year-round (highest abundances mid-spring through mid-fall)	N/A	Western North Atlantic	6,802	Unknown	1.85	Hayes et al. (2022)
Humpback whale	*Megaptera novaeangliae*	None/N	Common	Year-round (highest abundances mid-spring through fall)	N/A	Gulf of Maine	1,396	+2.8% per year (2000 through 2016)	12.15	Hayes et al. (2020)
Minke whale	*Balaenoptera acutorostrata*	None/N	Common	Year-round (highest abundances mid-spring through mid-fall)	N/A	Canadian East Coast	21,968	Unknown	10.55	Hayes et al. (2022)
North Atlantic right whale	*Eubalaena glacialis*	E/D	Common	Year-round (highest abundances late fall through spring)	Yes[8]	Western North Atlantic	338	–29.7% overall (2011 through 2020)	8.1	NMFS 2023a
Sei whale	*Balaenoptera borealis*	E/D	Regular	Year-round (highest abundances late spring and mid-fall)	N/A	Nova Scotia	6,292	Unknown	0.80	Hayes et al. (2022)
Odontocetes										
Atlantic spotted dolphin	*Stenella frontalis*	None/N	Rare	Rare	N/A	Western North Atlantic	39,921	Decreasing	Presumed 0	Hayes et al. (2022)
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	None/N	Common	Year-round	N/A	Western North Atlantic	93,233	Unknown	27.2	Hayes et al. (2022)
Blainville's beaked whale	*Mesoplodon densirostris*	None/N	Rare	Rare	N/A	Western North Atlantic	10,107[9]	Unknown	0.2	Hayes et al. (2020)
Common bottlenose dolphin (offshore)	*Tursiops truncatus*	None/N	Uncommon	Summer	N/A	Western North Atlantic, Offshore	62,851	Unknown	28	Hayes et al. (2020)
Common dolphin	*Delphinius delphis*	None/N	Common	Summer through winter (highest abundances fall)	N/A	Western North Atlantic	172,974	Unknown	390.4	Hayes et al. (2022)
Cuvier's beaked whale	*Ziphius cavirostris*	None/N	Rare	Rare	N/A	Western North Atlantic	5,744	Unknown	0.2	Hayes et al. (2020)
Dwarf sperm whale	*Kogia sima*	None/N	Rare	Rare	N/A	Western North Atlantic	7,750[10]	Unknown	Presumed 0	Hayes et al. (2020)
Gervais' beaked whale	*Mesoplodon europaeus*	None/N	Rare	Rare	N/A	Western North Atlantic	10,107[9]	Unknown	0	Hayes et al. (2020)

Common Name	Scientific Name	ESA/MMPA Status[1]	Relative Occurrence in the Proposed Action Activity Area[2]	Seasonal Occurrence in the Proposed Action Activity Area[3]	Critical Habitat in Area of Direct Effects	Stock (NMFS)	Population (Abundance) Estimate[4]	Population Trend[5]	Total Annual Human-Caused Mortality/ Serious Injury (M/SI)[6]	Reference
Harbor porpoise	*Phocoena phocoena*	None/N	Common	Year-round	N/A	Gulf of Maine, Bay of Fundy	95,543	Unknown	163	Hayes et al. (2022)
Killer whale	*Orcinus orca*	None/N	Rare	Rare	N/A	Western North Atlantic	Unknown	Unknown	Unknown	Waring et al. (2015)
Long-finned pilot whale	*Globicephala melas*	None/N	Regular	Late spring through fall	N/A	Western North Atlantic	39,215	Unknown	9	Hayes et al. (2022)
Northern bottlenose whale	*Hyperodon ampullatus*	None/N	Rare	Rare	N/A	Western North Atlantic	Unknown	Unknown	Presumed 0	Waring et al. (2015)
Pygmy sperm whale	*Kogia breviceps*	None/N	Rare	Rare	N/A	Western North Atlantic	7,750[10]	Unknown	Presumed 0	Hayes et al. (2020)
Risso's dolphin	*Grampus griseus*	None/N	Rare	Late fall through early winter	N/A	Western North Atlantic	35,215	Unknown	34	Hayes et al. (2022)
Short-finned pilot whale	*Globicephala macrorhynchus*	None/N	Rare	Rare	N/A	Western North Atlantic	28,924	Unknown	136	Hayes et al. (2022)
Sowerby's beaked whale	*Mesoplodon bidens*	None/N	Rare	Rare	N/A	Western North Atlantic	10,107[9]	Unknown	0	Hayes et al. (2020)
Sperm whale	*Physeter macrocephalus*	E/D	Uncommon	Year-round (highest abundances summer through early fall)	N/A	North Atlantic	4,349	Unknown	0	Hayes et al. (2020)
Striped dolphin	*Stenella coeruleoalba*	None/N	Rare	Rare	N/A	Western North Atlantic	67,036	Unknown	0	Hayes et al. (2020)
True's beaked whale	*Mesoplodon mirus*	None/N	Rare	Rare	N/A	Western North Atlantic	10,107[9]	Unknown	0.2	Hayes et al. (2020)
White-beaked dolphin	*Lagenorhynchus albirostris*	None/N	Rare	Rare	N/A	Western North Atlantic	536,016	Unknown	0	Hayes et al. (2020)
Pinnipeds										
Gray seal	*Halichoerus grypus*	None/N	Common	Year-round (highest abundances summer through mid-fall)	N/A	Western North Atlantic	27,300	Increasing	4,452	Hayes et al. (2022)
Harbor seal	*Phoca vitulina*	None/N	Common	Year-round (highest abundances summer through mid-fall)	N/A	Western North Atlantic	61,336	Unknown	339	Hayes et al. (2022)
Harp seal	*Pagophilus groenlandicus*	None/N	Uncommon	Late winter, early spring	N/A	Western North Atlantic	Unknown[11]	Increasing	178,573	Hayes et al. (2022)
Hooded seal	*Cystophora cristata*	None/N	Rare	Rare	N/A	Western North Atlantic	593,500	Increasing	1,680	Hayes et al. (2019)

[1] This denotes the highest federal regulatory classification (16 U.S. Code 1531 et seq. and 16 U.S. Code 1361 et seq.). A strategic stock is defined as any marine mammal stock:
a. for which the level of direct human-caused mortality exceeds the PBR level;
b. that is declining and likely to be listed as threatened under the ESA; or
c. that is listed as threatened or endangered under the ESA or as depleted under the MMPA.

[2] Relative occurrence in the Proposed Action Activity Area is defined as:
Common: occurring consistently in moderate to large numbers

Regular: occurring in low to moderate numbers on a regular basis or seasonally
Uncommon: occurring in low numbers or on an irregular basis
Rare: limited records exist for some years

[3] Seasonal occurrence, when available, was derived from abundance estimates using density models (MGEL, 2022; Roberts et al., 2016) and/or NMFS Stock Assessment Reports (Hayes et al., 2019, 2020; Hayes et al., 2021; Hayes et al., 2022; NMFS, 2023e; Waring et al., 2015). Seasons are depicted as follows: spring (March–May); summer (June–August); fall (September–November); winter (December–February).

[4] Unless otherwise noted, best available abundance estimates (Nbest) are from NMFS stock assessment reports (Hayes et al., 2019, 2020; Hayes et al., 2021; Hayes et al., 2022; NMFS, 2023e; Waring et al., 2015).

[5] Increasing = beneficial trend, not quantified; Decreasing = adverse trend, not quantified; Unknown = there are insufficient data to determine a statistically significant population trend (Hayes et al., 2019, 2020; Hayes et al., 2021; Hayes et al., 2022; NMFS, 2023e; Waring et al., 2015).

[6] The total annual estimated average human-caused mortality and serious injury (M/SI), if known, is the sum of detected mortalities/serious injuries resulting from incidental fisheries interactions and vessel collisions within the U.S. Exclusive Economic Zone. The value (number of individuals per year) represents a minimum estimate of human-caused mortality/serious injury only (Hayes et al., 2019, 2020; Hayes et al., 2021; Hayes et al., 2022; NMFS, 2023e; Waring et al., 2015).

[7] No best population estimate exists for the blue whale; the minimum population estimate is presented in this table (Hayes et al., 2020).

[8] Critical habitat for the NARW is established for its foraging area in the Gulf of Maine and calving area off the Southeast U.S. (81 *Federal Register* 4837).

[9] Estimated abundance is for *Mesoplodon* spp. (Blainville's [M. densirostris], Gervais' [M. europaeus], Sowerby's [M. bidens], and True's [M. mirus] beaked whales) (Hayes et al., 2020).

[10] Estimated abundance is for *Kogia* spp. (dwarf and pygmy sperm whales) (Hayes et al., 2020).

[11] Hayes et al. (2022) report insufficient data to estimate the population size of harp seals in U.S. waters; the best estimate for the whole population (range-wide) is 7.6 million.

D = depleted (strategic); E = endangered; MMPA = Marine Mammal Protection Act; N = non-strategic; N/A = not applicable; T = threatened

Fin whales are common and widespread throughout the Gulf of Maine, with highest abundances in the Proposed Action Activity Area from mid-spring through mid-fall (MGEL, 2022). NARWs are also common in the Gulf of Maine; visual and acoustic surveys indicate that NARWs may be present year-round in the Gulf of Maine, although the highest abundances occur from late-fall through spring (Davis et al., 2017; MGEL, 2022; NMFS, 2023e). Humpback whales are observed in the Gulf of Maine year-round, with peak abundances in the Proposed Action Activity Area occurring from mid-spring through fall (MGEL, 2022). Similarly, minke whales are present year-round in the Gulf of Maine, with highest abundances in the Proposed Action Activity Area recorded in mid-spring through mid-fall (MGEL, 2022). Sei whales typically express irregular movement patterns that appear to be associated with oceanic fronts, sea surface temperatures, and specific bathymetric features (Hayes et al., 2022; Olsen et al., 2009); the species is considered regular in the Gulf of Maine, with higher, though variable, densities in the Proposed Action Activity Area from late spring through mid-fall (MGEL, 2022). Sperm whales are primarily found in deeper offshore waters near the OCS edge beyond Georges Bank and in proximity to the prominent bathymetric features such as the Northeast Channel (Hayes et al., 2020); the species is considered uncommon within the Gulf of Maine, with seasonal occurrences in the Proposed Action Activity Area during the summer to early fall months (MGEL, 2022). Blue whales in the North Atlantic appear to target high-latitude feeding areas and may also utilize deep-ocean features at or beyond the shelf break outside the feeding season (Lesage et al., 2017; Lesage et al., 2018; Pike et al., 2009). Given their reported occurrence and habitat preferences, their presence in the Gulf of Maine is considered rare.

A wide variety of odontocete whale and dolphin species are expected to occur within the Gulf of Maine and Proposed Action Activity Area seasonally and year-round. These include the Atlantic white-sided dolphin (*Lagenorhynchus acutus*; year-round common occurrence), common bottlenose dolphin—offshore stock (*Tursiops truncates*; summer uncommon occurrence), common dolphin (*Delphinus delphis*; summer through winter common occurrence), long-finned pilot whale (*Globicephala melas*; regular late-spring through fall occurrence), and harbor porpoise (*Phocoena phocoena*; common year-round occurrence).

Pinniped species expected to commonly occur in the GAA are harbor seals (*Phoca vitulina*) and gray seals (*Halichoerus grypus*), both of which occur year-round in the Gulf of Maine, with highest occurrences in the Activity Area from summer through mid-fall in nearshore and coastal waters (MGEL, 2022). Harp seals (*Pagophilus groenlandicus*) may also occur in the Proposed Action Activity Area during the late winter to early spring, but are considered uncommon given their low seasonal occurrence (Hayes et al., 2022).

The most recent *Draft U.S. Atlantic and Gulf of Mexico Draft Marine Mammal Stock Assessment 2022* (NMFS, 2023e) indicated that there are insufficient data to determine population trends for most marine mammal species that utilize the Gulf of Maine. Humpback whale, gray seal, and harp seal population sizes are reportedly increasing, whereas the NARW population is decreasing (Hayes et al., 2020; Hayes et al., 2022; NMFS, 2023e). The humpback whale was previously federally listed as endangered. However, based on the revised listing completed by NOAA in 2016, the DPS of humpback whales that occurs along the East Coast of the United States (West Indies DPS) is no longer considered endangered or threatened (Hayes et al., 2020). This stock continues to experience a positive trend in abundance (Hayes et al., 2020). However, an Unusual Mortality Event (UME)[1] was declared for this species in January 2016, and

[1] UME data presented in this section current as of May 30, 2023.

since then, 44 humpback whales have stranded in Maine, New Hampshire, and Massachusetts, with 194 total along the Atlantic coast from Maine to Florida (NMFS, 2023a). A potential leading cause of the ongoing UME is vessel strikes. A recent uptick in large whale strandings during late 2022 and early 2023 along the New Jersey and New York coastlines, primarily of humpback whales, is currently being evaluated by NMFS. In addition, a UME was declared for the minke whale in January 2017 (NMFS, 2023b). A total of 147 individuals stranded from Maine to South Carolina, with 89 occurring in Maine, New Hampshire, and Massachusetts (NMFS, 2023b). Preliminary results of necropsy examinations indicate evidence of human interactions or infectious disease; however, these results are not conclusive (NMFS, 2023b). The minke whale UME (NMFS, 2023b) is currently considered nonactive and pending closure by NMFS, although full closure is not yet established.

Between July 2018 and March 2020, increased numbers of gray seal and harbor seal mortalities have been recorded across Maine, New Hampshire, and Massachusetts, with strandings as far south as Virginia (NMFS, 2022a). This event was declared a UME by NMFS and encompasses 3,152 seal strandings, with 3,039 reported in Maine, New Hampshire, and Massachusetts (NMFS, 2022a). The pathogen phocine distemper virus was found in most deceased seals and, based on this finding, has been identified as the cause of the UME. This UME is no longer active and pending closure by NMFS (NMFS, 2022a). Since June 2022, elevated gray seal and harbor seal mortalities have been recorded along coastal Maine (NMFS, 2023d). This event was declared a UME by NMFS and is currently ongoing, with 378 mortalities along the central and southern Maine coast (NMFS, 2023d). Seals have tested positive for the highly pathogenic avian influenza (NMFS, 2023d).

The NARW is considered to be one of the most biologically sensitive species within the GAA. There have been elevated numbers of NARW mortalities and injuries reported since 2017, which prompted NMFS to designate a UME for NARWs (NMFS, 2023c). These elevated mortalities and injuries have continued into 2023, with a total of 98 individuals reported dead or to have sustained serious or sublethal injuries or illness in U.S. and Canadian waters to date (NMFS, 2023c). This includes 36 confirmed mortalities, 33 live free-swimming whales with serious injuries due to entanglement or vessel strike, and 29 individuals observed with sublethal injuries or illness documented to date (NMFS, 2023c). Human interactions (e.g., fishery-related entanglements and vessel strikes) are the most likely cause of this ongoing UME. Despite the recent optimistic number of births, the species continues to be in severe decline, which prompted the International Union for Conservation of Nature to update the species' Red List status in July 2020 from endangered to critically endangered, noting its high risk for global extinction (Cooke, 2020). Data show the NARW population declined in abundance from 2011 to 2020. Recruitment of new individuals from births remains low, with mortalities exceeding births by 3:2 during the 2017 to 2020 timeframe (Pettis et al., 2021, 2022). Although births in 2021 were higher than in 2020, mortalities continue to exceed the species' calculated potential biological removal (PBR)[2] (NMFS, 2023e; Pettis et al., 2021, 2022). The current PBR for NARWs is 0.7 individual, whereas the total annual observed human-caused mortality and serious injury is 8.1 individuals (NMFS, 2023e). Not all mortalities are detected (NMFS, 2023e), and overall mortality is likely higher than estimated (Pace, 2021); modeling suggests the mortality rate could be as high as 31.2 animals per year (NMFS, 2023e). Most recent data continue to indicate substantial population decline, up to 29.7 percent since 2011 (NMFS, 2023e). The current population estimate for NARWs is at its lowest point in nearly 20 years, with a best-estimated 338

[2] The calculated PBR is the maximum number of animals, not including in natural mortalities, that may disappear annually from a marine mammal stock while allowing that stock to reach or maintain its optimal sustainable population level.

individuals remaining (NMFS, 2023e; Pettis et al., 2022). Additional information about the current population status for NARWs is provided in the most recent stock assessment report (NMFS, 2023e). The species' high mortality rate is driven primarily by fishing gear entanglement and vessel strike (NMFS, 2023e). When coupled with the species' low fecundity and small population size, all human-caused mortalities have the potential to affect its population status.

Critical habitat for the NARW within the marine mammal GAA comprises the Gulf of Maine feeding areas in Cape Cod Bay, Stellwagen Bank, and the Great South Channel (81 *Federal Register* 4837) (**Figure 3-3**). Additional NARW critical habitat is designated in the species' nearshore calving grounds that stretch from Cape Canaveral, Florida to Cape Fear, North Carolina; this portion of NARW critical habitat does not overlap with the marine mammal GAA.

The Gulf of Maine is a highly diverse and dynamic habitat region that supports many key biological functions for several marine mammal species both seasonally and year-round. Multiple marine mammal biologically important area (BIA) classifications have been identified within the Gulf of Maine, including seasonal and spatially explicit BIAs for small resident populations (harbor porpoise: July through September) and reproduction (humpback whales: November through January). The majority of the identified BIAs are for foraging, which include seasonal and spatially explicit regions for the sei whale (Gulf of Maine: May through November), minke whale (Southwestern Gulf of Maine and Georges Bank: March through November; Central Gulf of Maine Parker Ridge and Cashes Ledge: March through November), humpback whale (Gulf of Maine, Stellwagen Bank, and Great South Channel: March through December), fin whale (Southern Gulf of Maine: year-round; Northern Gulf of Maine: June through October), and NARW (Great South Channel and Georges Bank Shelf Break: April through June; Cape Cod Bay and Massachusetts Bay: February through April; Jeffreys Ledge: June through July and October through December). Additional detailed information for each BIA may be found in LaBrecque et al. (2015) and at https://cetsound.noaa.gov/biologically-important-area-map (NOAA Fisheries, 2023a).

As indicated by the BIAs discussed above, the Gulf of Maine represents important foraging habitat for many marine mammal species. Within the Gulf of Maine, fin, humpback, and minke whales feed mainly on small schooling fish such as herring, sand lance, young mackerel, and krill (DMR, 2022). Foraging habits of NARWs show a clear preference for the late juvenile developmental stage of the zooplanktonic copepod *Calanus finmarchicus* (Mayo et al., 2001). This species occurs in dense patches and demonstrates both diel and seasonal vertical migration patterns (Baumgartner et al., 2011). The NARW distribution and movement patterns within its foraging grounds is highly correlated with concentrations and distributions of its prey, which exhibit high variability within and between years (Pendleton et al., 2012).

Marine mammals in the GAA are subject to a variety of ongoing human-caused impacts that overlap with the Proposed Action, including collisions with vessels (ship strikes), entanglement with fishing gear, fisheries bycatch, anthropogenic noise, disturbance of marine and coastal environments, effects on benthic habitat, disease, and climate change (NMFS, 2023e). Many marine mammal migrations cover long distances, and these factors can have impacts on individuals over broad geographical scales.

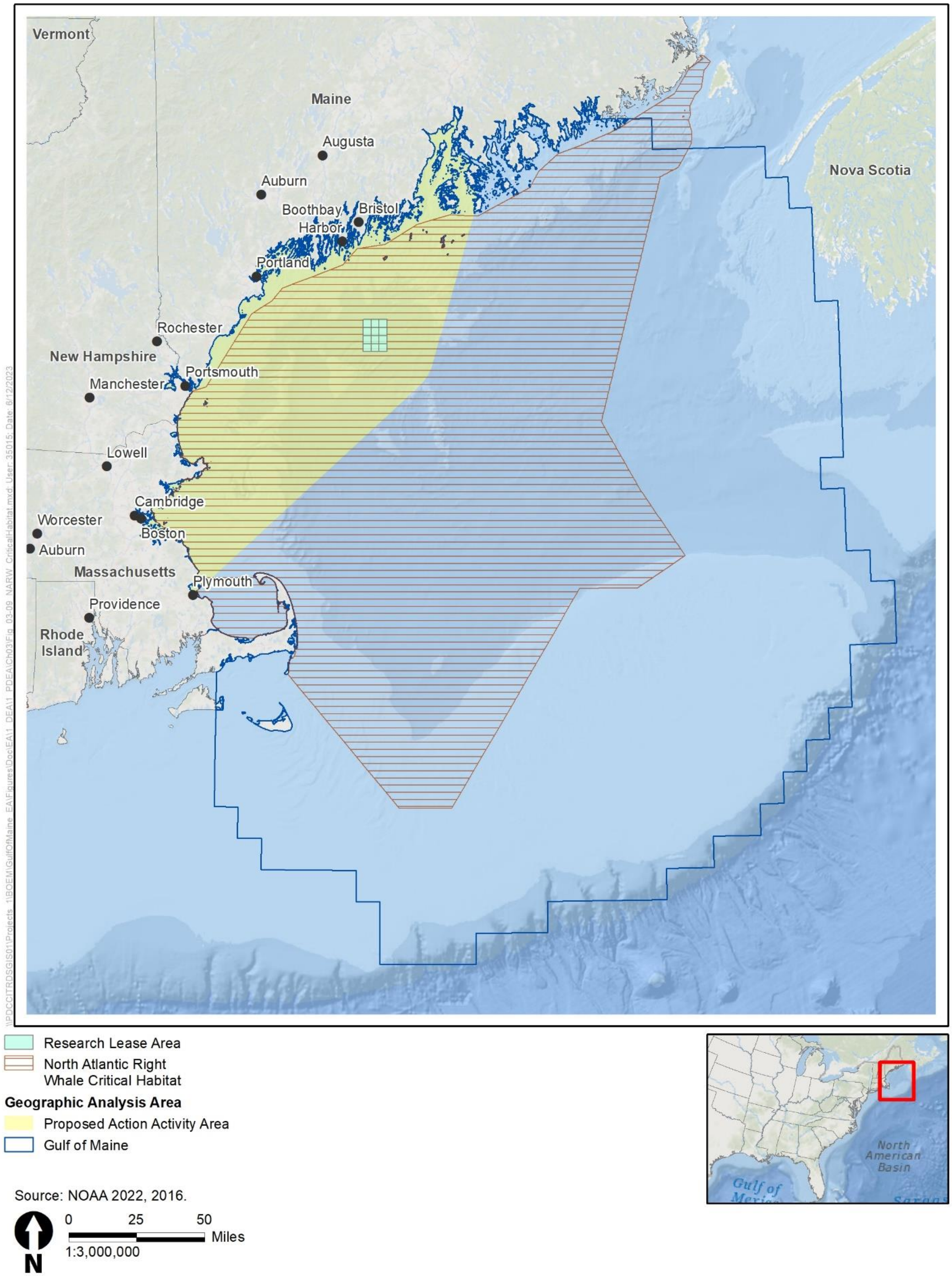

Figure 3-3. North Atlantic right whale northeastern critical habitat within the Gulf of Maine

Vessel strike is relatively common with cetaceans (Kraus et al., 2005) and one of the primary causes of anthropogenic mortality in large whale species (Hayes et al., 2020; Hayes et al., 2022; Hill et al., 2017; Jensen and Silber, 2003; NMFS, 2023e; van der Hoop et al., 2013; van der Hoop et al., 2015). NARW is particularly vulnerable to vessel strikes based on the distribution of preferred coastal region habitats and its feeding, diving, and socializing behaviors (Baumgartner et al., 2017). Risk of collision injury is commensurate with vessel speed; the probability of a vessel strike increases significantly as speeds increase above 10 knots (Conn and Silber, 2013; Kite-Powell et al., 2007; Laist et al., 2001; Vanderlaan and Taggart, 2007). Vessels operating at speeds exceeding 10 knots under poor visibility conditions have been associated with the highest risk for vessel strikes of NARWs (Vanderlaan and Taggart, 2007), although collisions at lower speeds are still capable of causing serious injury, even when smaller vessels (fewer than 20 meters in length) are involved (Kelley et al., 2020).

Entanglement in fishing gear, most notably pot/trap type fisheries that utilize a vertical buoy line, and vessel strike have been identified as the leading causes of mortality in NARWs and may be a limiting factor in the species' recovery (Johnson et al., 2005; King et al., 2021; Knowlton et al., 2012; NMFS, 2023e). Current estimates indicate that 83 percent of NARWs show evidence of at least one past entanglement and 60 percent show evidence of multiple fishing gear entanglements, with rates increasing over the past 30 years (King et al., 2021; Knowlton et al., 2012). Of documented NARW entanglements in which gear was recovered, 80 percent were attributed to non-mobile fishing gear (i.e., lobster and gillnet gear) (Knowlton et al., 2012). Entanglement and vessel strike may also be responsible for high mortality rates in other large whale species (Read et al., 2006); the Final Environmental Impact Statement, Regulatory Impact Review, and Final Regulatory Flexibility Analysis for Amending the Atlantic Large Whale Take Reduction Plan: Risk Reduction Rule (NOAA, 2021) provides an analysis of data that show entanglement in commercial fisheries gear also represents the highest proportion of all documented serious and non-serious incidents reported for humpback, fin, and minke whales.

Global climate change is also an ongoing risk for marine mammal species in the GAA. Climate change is known to increase ocean temperatures, increase ocean acidity, change ocean circulation patterns, raise sea levels, alter precipitation patterns, increase the frequency and intensity of storms, and increase freshwater runoff, erosion, and sediment deposition. Impacts associated with climate change have the potential to reduce long-term foraging and reproductive success, increase individual mortality and disease occurrence, and affect the distribution and abundance of prey resources for marine mammals (Gulland et al., 2022; Love et al., 2013; NASA, 2023; EPA, 2022a). Long-term data show that water temperatures in the Gulf of Maine have been increasing over the last decade at a rate faster than in 97 percent of the world's oceans (Balch et al., 2022; Gulf of Maine Research Institute, 2023; Pershing et al., 2021; Pershing et al., 2015; Seidov et al., 2021). The temperature changes have a cascading effect on all trophic levels that will likely have long-term consequences on marine species that may not be recoverable (Pershing et al., 2021; Pershing et al., 2015). The extent of these effects is unknown; however, populations already stressed by other factors likely will be the most affected by the repercussions of climate change, particularly in the Gulf of Maine given its importance for many marine mammal species as discussed above.

3.2.7 Sea Turtles

Four species of sea turtles may occur within the Gulf of Maine: green (*Chelonia mydas*), Kemp's ridley (*Lepidochelys kempii*), leatherback (*Dermochelys coriacea*), and loggerhead (*Caretta caretta*) sea turtles (**Table 3-6**). Sea turtles are highly migratory. As ocean waters warm in the spring, sea turtles migrate northward to their feeding grounds, typically arriving in the Mid-Atlantic and Northeast from spring to summer and remaining through the fall. As water temperatures cool, most sea turtles begin their return migration to the south to nesting grounds in the southern U.S., Gulf of Mexico, and Caribbean. Historically, this southward migration begins in mid- to late fall.

Table 3-6. Sea turtles that may occur within the Gulf of Maine and in the vicinity of the Proposed Action Activity Area

Common Name	Scientific Name	Distinct Population Segment/ Population	ESA Status	Relative Occurrence in the Proposed Action Activity Area[1]	Seasonal Occurrence in the Proposed Action Activity Area[2]
Green sea turtle	*Chelonia mydas*	North Atlantic	Threatened	Uncommon	Summer through Fall
Kemp's ridley sea turtle	*Lepidochelys kempii*	--	Endangered	Regular	Summer through Fall
Leatherback sea turtle	*Dermochelys coriacea*	Northwest Atlantic	Endangered	Regular	Summer through Fall
Loggerhead sea turtle	*Caretta caretta*	Northwest Atlantic	Threatened	Uncommon	Summer through Fall

[1] Relative occurrence in the Proposed Action Activity Area is defined as:
Common: occurring consistently in moderate to large numbers
Regular: occurring in low to moderate numbers on a regular basis or seasonally
Uncommon: occurring in low numbers or on an irregular basis
Rare: limited records exist for some years

[2] Seasonal occurrence was derived using NMFS (2023g), stranding data (NMFS, 2023f), and species-specific review and recovery documents (NMFS and USFWS, 2007; NMFS and USFWS, 2008; NMFS and USFWS, 2015; NMFS and USFWS, 2020; NMFS and USFWS, 2023). Seasons are depicted as follows: spring (March–May); summer (June–August); fall (September–November); winter (December–February). Cold-stunned individuals may be present into winter months.

In general, the Gulf of Maine, including the Proposed Action Activity Area, is near the northern extent for most sea turtle species (except leatherback), with generally low rates of occurrences compared to warmer Mid-Atlantic and southern waters. Sea turtles utilizing the Gulf of Maine are most likely to be foraging, with no documented nesting events within the Gulf of Maine for any sea turtle species. The leatherback sea turtle is expected to be the most common of the four species that occur within the Gulf of Maine. Sea turtle presence in northern waters, including the Gulf of Maine, is correlated with the highest annual sea surface temperatures (i.e., late summer to fall). Individuals that remain in northern waters longer than this are susceptible to cold stunning or death, which occurs when water temperatures fall below 50 degrees Fahrenheit (10°C) (NMFS, 2021). Although the extent and impact on sea turtles remains largely unknown, habitat use within the Gulf of Maine may increase in the future due to the rapid warming of the Gulf of Maine (Griffin et al., 2019; Gulf of Maine Research Institute, 2023).

Green sea turtles may be found as far north as Nova Scotia and may be found within the Gulf of Maine, spending most of their time in coastal foraging areas, including open coastline waters (NMFS and USFWS, 2007). Juveniles occur more frequently than adults in the Northeast Atlantic, migrating northward and residing in the New England area from June through November (NMFS, 2022c; NMFS, 2023g). Adult Kemp's ridley sea turtles undergo seasonal migration each year in the Atlantic, starting their journey to northern foraging grounds in spring, reaching as far north as Cape Cod Bay by June, and traveling back to southern habitat in the fall (Waring et al., 2012). 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, 2022c) and nearshore waters fewer than 120 feet deep (Shaver and Rubio, 2008; Shaver et al., 2005), although they can also be found in deeper offshore waters. The highly mobile and migratory leatherback sea turtle is widely dispersed throughout the Northwest Atlantic. The species is most likely to occur within the Gulf of Maine during the summer months (Musick and Limpus, 1996). The continental slope to the east and south of Cape Cod and the OCS south of Nantucket appear to be hotspots, where several tagged leatherback sea turtles were observed feeding for extended periods (James et al., 2006). Loggerhead sea turtles may also occur within the Gulf of Maine, although their presence is considered uncommon (Warden, 2011); they are most likely to occur during the summer and fall when sea surface temperatures are greatest. Loggerhead sea turtles occur in pelagic, nearshore, and coastal inshore waters dependent upon life stage; benthic immature loggerheads have been reported in waters off Cape Cod, Massachusetts (TEWG, 2009).

Adult green sea turtles forage mostly on seagrasses and algae (Bjorndal, 1997), although they will occasionally feed on sponges and invertebrates (NMFS, 2022c). Kemp's ridley sea turtles are generalist feeders that prey on a variety of species including crustaceans, mollusks, fish, jellyfish, and tunicates, and forage on aquatic vegetation (Byles, 1988; Carr and Caldwell, 1956; Schmid, 1998). However, the preferred diet of the Kemp's ridley sea turtle is crabs (NMFS and USFWS, 2015). Leatherback sea turtles are dietary specialists, feeding almost exclusively on jellyfish, siphonophores, and salps, and the species' migratory behavior is closely tied to the availability of pelagic prey resources (Eckert et al., 2012; NMFS and USFWS, 2020). Prey species for omnivorous juvenile loggerheads include crab, mollusks, jellyfish, and vegetation at or near the surface; coastal subadults and adults feed on benthic invertebrates including mollusks and decapod crustaceans (TEWG, 2009).

Data from the NOAA Fisheries Sea Turtle Stranding and Salvage Network show two strandings of green sea turtles in Maine and Massachusetts within the Gulf of Maine between January 1, 2018, and May 25, 2023, due to traditional stranding and cold stunning (NMFS, 2023f). Ten Kemp's ridley sea turtle strandings are documented in Maine and Massachusetts within the Gulf of Maine during the same time period, largely the result of cold-stunning reasons, with three traditional strandings (NMFS, 2023f). Stranding data indicate 28 strandings of leatherback sea turtles in Maine and Massachusetts within the Gulf of Maine during the same time period, with half resulting from incidental capture and the remaining from traditional strandings (NMFS, 2023f). Finally, nine loggerhead sea turtle strandings are documented in the Gulf of Maine for this same time period, largely the result of traditional stranding causes and all occurring within Massachusetts (NMFS, 2023f).

All sea turtles within the GAA are listed under the ESA as either endangered (Kemp's ridley [35 *Federal Register* 18319]; leatherback [35 *Federal Register* 8491]) or threatened (green–North Atlantic DPS [81 *Federal Register* 20057]; loggerhead–Northwest Atlantic Ocean DPS [76 *Federal Register* 58868]). Nesting trends for leatherback sea turtles are decreasing at nesting beaches with the greatest known nesting female abundance (NMFS and USFWS, 2020). The three largest loggerhead sea turtle nesting subpopulations have been declining since at least the late 1990s, indicating a downward trend for this population (TEWG, 2009). 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, 2023). Kemp's ridley sea turtles began to recover in abundance and nesting productivity since conservation measures were initiated following its ESA listing. However, since 2009, the number of successful nests has declined markedly (NMFS and USFWS, 2015). The most recent status review for the North Atlantic DPS of green sea turtle estimates that nesting trends are generally increasing (Seminoff et al., 2015). There is no sea turtle critical habitat designated within the GAA.

Similar to marine mammals, all four sea turtle species likely to occur in the GAA are subject to regional, ongoing threats. These threats include fisheries bycatch, loss or degradation of habitat, entanglement in fishing gear, vessel strikes, predation and harvest, disease, and climate change. Vessel-animal collisions are a measurable and increasing source of mortality and injury for sea turtles. Sea turtles are expected to be most vulnerable to vessel strikes in coastal foraging areas and may not be able to avoid collisions when vessel speeds exceed 2 knots (1 meter per second) (Hazel et al., 2007). A primary threat to sea turtles is their unintended capture in fishing gear, which can result in drowning or cause injuries that lead to mortality (e.g., swallowing hooks). For example, trawl fishing is among the greatest continuing primary threats to the loggerhead turtle (NMFS and USFWS, 2008) and sea turtles are also caught as bycatch in other fishing gear including longlines, gillnets, hook and line, pound nets, pot/traps, and dredge fisheries. A substantial impact of commercial fishing on sea turtles is the entrapment or entanglement that occurs with a variety of fishing gear, both mobile (i.e., trawl) and stationary (i.e., pots). Available data also suggest changing ocean temperatures and sea level rise may lead to changes in the sex ratio of sea turtle populations (Booth et al., 2020), loss of nesting area, and a decline in population growth due to incubation temperature reaching lethal levels (Patrício et al., 2019; Varela et al., 2019).

3.2.8 Military Use

Three military Danger Zones/Restricted Areas, areas where general use by the U.S. government may limit public access, exist within the Gulf of Maine: a 1.5-nm (2.8-km) radius circle just easterly of Seal Island used as a naval aircraft bombing target area; a rectangular danger zone off Cape Small used as a naval aircraft practice mining range area; and a 1-nm (1.8-km) radius circle 7.9 nm (14.6 km) from Pemaquid Point used as a naval sonobuoy test area (33 CFR Part 334.10–30). **Figure 3-4** shows the locations of military use areas in relation to the Research Lease Area.

The Boston Range Complex is a surface and subsurface operating area off the coast of Maine, New Hampshire, and Massachusetts used for U.S. Navy fleet training and testing activities and consists of associated special use airspace. Airspace Warning Area W-103 overlaps with the GAA and is used for surface and anti-submarine warfare tactics (U.S. Department of the Navy, 2013).

Additional activities in the region include the U.S. Navy sea trials of Arleigh Burke-class destroyers that include a series of in-port and at-sea demonstrations to assess the ship's systems and take place in the vicinity of Bath, Maine and offshore in the Gulf of Maine. Six vessels are under contract to be built in a shipyard in Bath, Maine (Shelbourne, 2023). USCG activities in the region include search and rescue missions and response to oil discharges and hazardous substance releases into the navigable waters under the agency's Marine Environmental Protection mission.

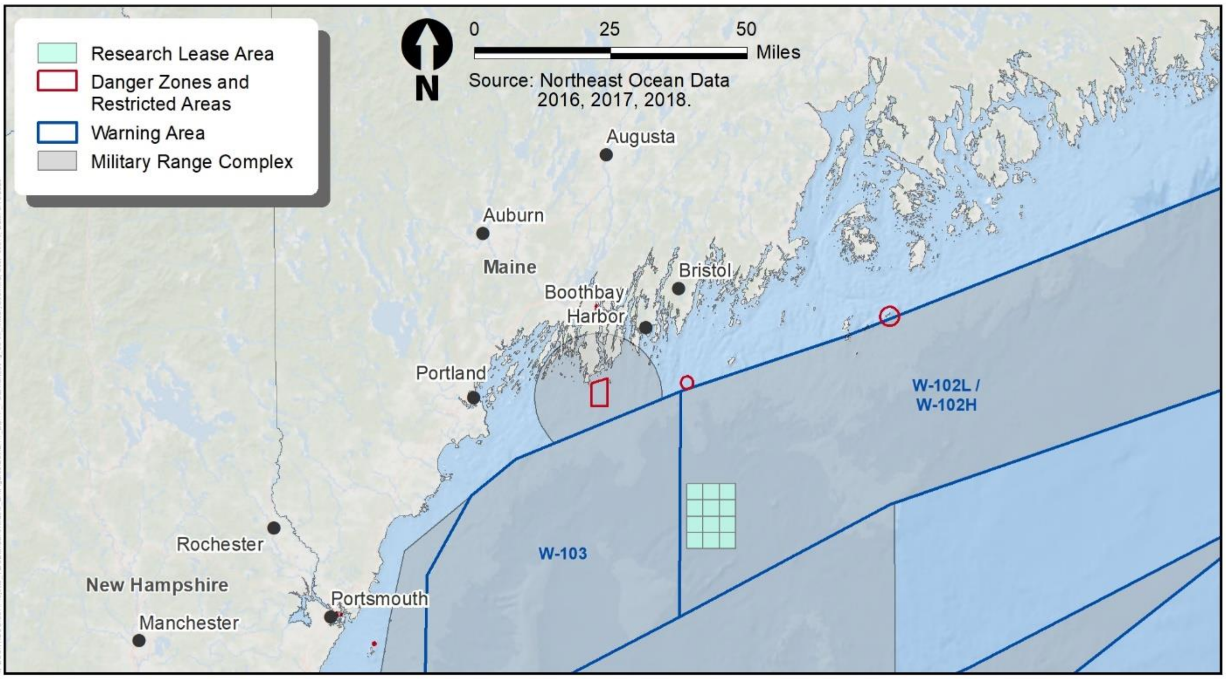

Figure 3-4. Military use areas in the vicinity of the Research Lease Area within the Gulf of Maine

3.2.9 Navigation and Vessel Traffic

In 2021, state and federally licensed commercial anglers made 392,000 trips, mostly by lobster license holders in the Gulf of Maine, although other fisheries such as groundfish, scallop, and tuna are also active and contribute to the varied and extensive vessel traffic throughout the year (Burgess, 2022). While fishing vessels are the most prevalent vessel type, cargo vessels, very large crude carriers, cruise vessels, container vessels, towing vessels, barges, and military vessels also transit the Gulf of Maine. There are four principal ports within the navigation and vessel traffic GAA: Searsport and Portland, Maine; Portsmouth, New Hampshire, and Boston, Massachusetts (USACE, 2023b).

Table 3-7. All commercial vessel counts for the four major ports in the Gulf of Maine

Port	2017	2018	2019	2020	Average
Searsport, Maine	152	249	195	223	205
Portland, Maine	41,459	51,175	41,765	35,122	42,380
Portsmouth, New Hampshire	335	373	338	310	339
Boston, Massachusetts	5,613	2,853	2,891	1,790	3,287
Total	**47,649**	**51,650**	**45,189**	**37,445**	**45,483**

Source: USACE, 2023b.

The Isles of Shoals North Disposal Site is approximately 10.5 miles east of Portsmouth, New Hampshire. It is an active disposal site used for materials collected during dredging operations in federal channels, authorized for approximately 1.5 million cubic yards of material over a 20-year period. There are two Areas to be Avoided just outside of the seaward boundary on the approach to Boston, Massachusetts (Northeast Regional Ocean Council, 2009). There are three precautionary areas leading to and from the TSSs for Portland, Boston, and Cape Cod Bay (**Figure 3-5**).

In 2023, USCG completed the Approaches to Maine, New Hampshire, and Massachusetts Port Access Route Study, which used multiple sources of data, such as the Automated Identification System (AIS), Vessel Monitoring System (VMS) traffic, commercial fishing statistics, public comments, and partner agency submissions to determine if routing measure revisions are necessary to improve navigation safety (USCG, 2023). The study concluded that port expansion projects, changes in fishery management and species distributions, and offshore renewable energy infrastructure may result in the introduction of larger vessel classes, greater traffic densities, and displacement of some traditional transit routes within the GAA and recommended implementation of six additional shipping safety fairways (**Figure C-1**) that will preserve unobstructed transit of densely traveled routes and port approaches to mitigate a heightened risk of marine casualties.

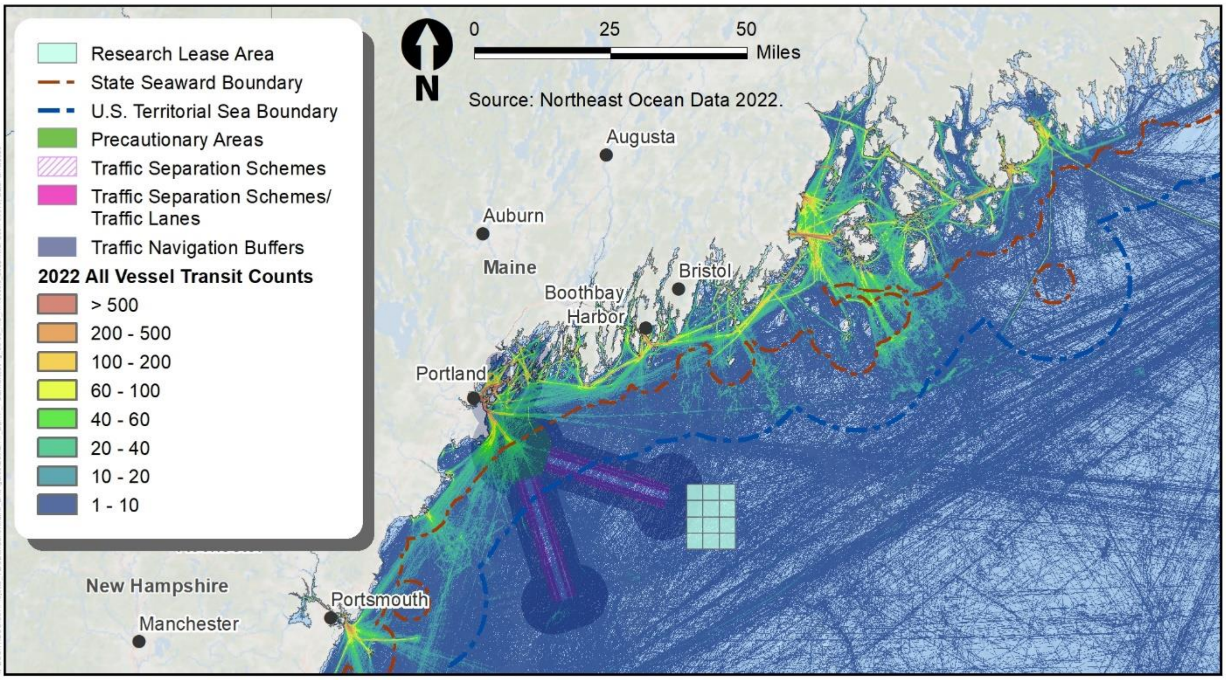

Figure 3-5. Automatic Identification System vessel track lines, 2022

For the Approaches to Maine, New Hampshire, and Massachusetts Port Access Route Study, the USCG Navigation Center provided AIS data and VMS data for the area of study from 2019 through 2021 as shown in **Table 3-8**. **Figure 3-5** depicts AIS vessel transit counts in 2022.

Table 3-8. Vessel tracks and unique vessel counts by type for the Gulf of Maine (2019–2021)

Vessel Type	Vessel Track Counts (in thousands)				Unique Vessel Counts			
	2019	2020	2021	Average	2019	2020	2021	Average
Pleasure/Sailing	12.1	13	12.5	12.4	1,916	1,933	2,087	1,979
Not available	4.2	1.5	6.2	4.0	470	94	763	442
Fishing	12.1	12[1]	13.1[1]	12.4[1]	266	269[1]	316[1]	283[1]
Cargo	1	0.8	0.8	0.9	254	225	207	229
Tug/Tow	3.5	2.1	1.9	2.5	161	133	135	143
Tanker	1	1	1.2	0.7	140	124	151	138
Other	2.2	1.9	2	2	99	105	102	102
Passenger	5.3	3	4.3	4.2	126	79	78	94
Military	0.1	< 0.1	< 0.1	< 0.1	12	6	11	10
Total	**41.5**	**35.3**	**42**	**39.2**	**3,444**	**2,968**	**3,844**	**3,419**

Source: USCG, 2023.

[1] VMS data used. All other data from AIS.

These counts provide a broad overview of the amount and type of vessels present in the Gulf of Maine from 2019 to 2021. AIS and VMS data sources can capture the presence of unique fishing vessels; however, both AIS and VMS data sources likely underestimate the volume of fishing vessel activity in the area because not all vessels are required to use AIS or VMS transceivers. If there was a discrepancy between the AIS and VMS data, the higher vessel quantity is shown (USCG, 2023).

Table 3-9 reports the amount and type of vessels intersecting the State of Maine's requested lease area from 2019 to 2021. Pleasure craft/sailing traffic, fishing vessels, and tankers were the most common vessel types transiting through the requested lease area. Vessel traffic volume during the study period was relatively low, with an average of 217 vessel tracks per year, including 67 pleasure craft/sailing traffic tracks, 58 fishing tracks, and 27 tanker tracks per year.

Table 3-9. Vessel tracks and unique vessel counts by type intersecting the State of Maine's requested lease area (2019–2021)

Vessel Type	Vessel Track Counts				Unique Vessel Counts			
	2019	2020	2021	Average	2019	2020	2021	Average
Pleasure/Sailing	67	67	68	67	58	64	65	62
Fishing	65	62[1]	47[1]	58[1]	22	24[1]	15[1]	20[1]
Tanker	29	25	27	27	15	17	17	16
Cargo	22	27	13	21	10	9	5	8
Not available	24	6	23	18	19	4	19	14
Passenger	40	0	2	14	25	0	2	9
Tug/Tow	8	6	6	7	5	3	2	3
Other	4	7	4	5	2	6	3	4
Military	0	0	1	0.3	0	0	1	0.3
Total	**259**	**200**	**191**	**217**	**156**	**127**	**129**	**137**

Source: USCG, 2023.
[1] VMS data used. All other data from AIS.

Over the timeframe considered in this EA, it is likely that commercial vessel traffic for the Gulf of Maine will continue using ports and transiting within the GAA. There is a clear decline in vessel traffic for the major ports of call during the COVID era; however, it is anticipated that counts will continue to rise and return to pre-COVID levels in the near future.

3.2.10 Commercial and Recreational Fishing

Multiple commercial and recreational fishing grounds and banks are located within the Gulf of Maine. VMS data are a good source of information for monitoring the location and movement of commercial fishing vessels in the United States. The data, however, do not distinguish between areas of active fishing and vessel transits, and therefore may appear to show heavy density of fishing vessels near ports and along transit corridors even though little to no fishing may be occurring at those locations. Additionally, not all commercial fishing vessels are required to be VMS-enabled, including those fishing for American lobster. Pentony (2022) noted that an analysis suggested that less than 4 percent of lobster landings in the Gulf of Maine were from VMS-enabled vessels. Therefore, with the exception of the American lobster fishery, VMS data can provide a reasonably good indicator of commercial fishing vessel locations near the Research Lease Area (**Figure 3-6**).

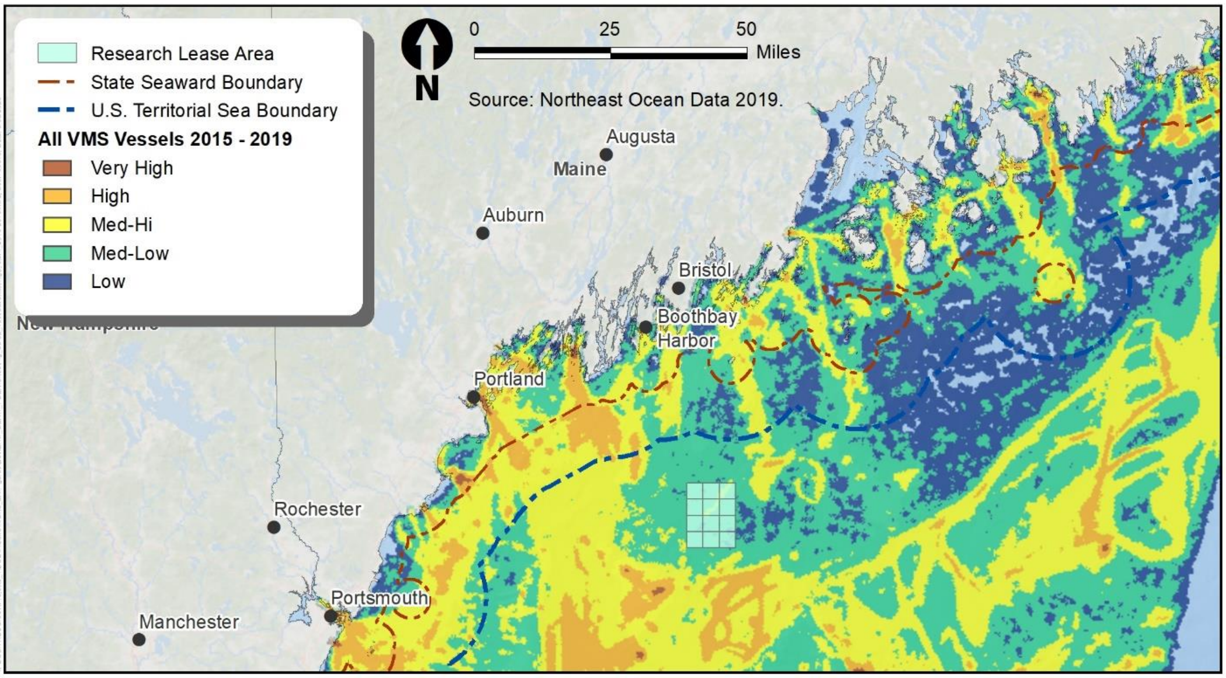

Figure 3-6. Vessel Monitoring System data for all fisheries, 2015–2019

Fisheries in the GAA are managed at both the federal and regional level. At the federal level, there is one council in the GAA designated by the Magnuson-Stevens Fishery Conservation and Management Act: the NEFMC for Connecticut, Massachusetts, Maine, New Hampshire, and Rhode Island. The GAA for commercial and recreational fishing is entirely within the jurisdiction of NEFMC. At the regional level, the 15 Atlantic states form the Atlantic States Marine Fisheries Commission. **Table 3-10** identifies the management jurisdiction for top commercially targeted fish species in the Gulf of Maine.

Table 3-10. Federal and regional management jurisdiction for top fisheries in the Gulf of Maine

Species	New England Fishery Management Council (Federal)	Mid-Atlantic Fishery Management Council (Federal)	Atlantic States Marine Fisheries Commission (Regional)	NOAA Fisheries / Atlantic Highly Migratory Species Management Division
American Lobster			X	
Atlantic sea scallop	X			

Species	New England Fishery Management Council (Federal)	Mid-Atlantic Fishery Management Council (Federal)	Atlantic States Marine Fisheries Commission (Regional)	NOAA Fisheries / Atlantic Highly Migratory Species Management Division
Bluefin tuna				X
Haddock	X			
Herring	X		X	
Mahogany quahog		X		
Monkfish	X	X		
Northeast Multispecies (groundfish)[1]	X			

[1] The Northeast Multispecies (groundfish) fishery includes Acadian redfish, American plaice, Atlantic cod, Atlantic halibut, Atlantic pollock, Atlantic wolffish, haddock, ocean pout, red hake, silver hake, white hake, windowpane flounder, winter flounder, witch flounder, and yellowtail flounder.

NOAA Fisheries maintains landings data for commercial and recreational fisheries based on year, state, and species. Commercial fisheries that utilize the waters in the Proposed Action Activity Area to the greatest extent include the American lobster, menhaden, and Atlantic sea scallop fisheries. The American lobster fishery accounts for approximately 49.5 percent of the total fishing revenue from Maine, New Hampshire, and Massachusetts waters, and 77.8 percent of revenue when considering Maine alone based on 2021 landings data (NOAA Fisheries, 2021). Additional fisheries include menhadens, haddock, herring, monkfish, northeast multispecies (groundfish), skates, bluefin tuna, and mahogany quahog (Pentony, 2022). **Table 3-11** presents a summary of the 2021 commercial revenue and landings for the top ten species by landings weight for Maine, New Hampshire, and Massachusetts combined.

Table 3-11. Commercial revenue and landings summary for 2021 for the top ten species by landings weight for Maine, New Hampshire, and Massachusetts

Species	Pounds	U.S. Dollars
American Lobster	133,123,947	911,870,312
Menhadens	51,614,775	67,455,461
Atlantic Sea Scallop	34,362,872	526,177,398
Withheld for Confidentiality	28,877,550	67,001,453
Haddock	16,104,300	19,914,903
Seaweed/Rockweed	15,824,186	1,446,811
Shortfin Illex Squid	15,046,776	5,896,499

Species	Pounds	U.S. Dollars
Acadian Redfish	12,447,761	7,096,449
Goosefish	12,013,904	7,943,075
Ocean Quahog	11,357,355	9,933,145

Source: NOAA Fisheries, 2021.

There are multiple recreational fishing areas within the Gulf of Maine, many of which are along the shoreline (DMR, 2023c). There are also numerous charter and head boats available in Maine that target a variety of species including striped bass, bluefin tuna, mackerel, sharks, bluefish, and others (DMR, 2023b). In 2022, the fisheries with the highest landings included Atlantic mackerel striped bass, pollock, and other cods/hakes, each with over one million pounds landed. **Table 3-12** presents a summary of the 2022 recreational landings for Maine, New Hampshire, and Massachusetts combined (NOAA Fisheries, 2023c). NMFS (2022b) reports that haddock had the highest number of fish kept between 2008 and 2020 (1,051,481 individuals), followed by pollock (631,685), cod (521,827), and Atlantic mackerel (369,957). For more information on fish species potentially present in the GAA, see **Section 3.2.5** and the EFH Assessment prepared in support of this EA (BOEM, 2023c).

Table 3-12. Recreational landings summary for 2022 for Maine, New Hampshire, and Massachusetts

Species/Species Group	Pounds
Atlantic Mackerel	4,630,842
Striped Bass	2,463,647
Pollock	1,221,358
Other Cods/Hakes	1,086,148
Herrings	966,690
Black Sea Bass	765,567
Atlantic Cod	478,443
Dogfish Sharks	382,671
Sculpins	199,258
Other Tunas/Mackerels	146,645

Source: NOAA Fisheries, 2023c.

Generally, the activity and value of fisheries are expected to remain fairly stable during the timeframe considered in this EA. Commercial fisheries and recreational fishing in the Gulf of Maine are subject to pressure from ongoing activities including regulated fishing effort, vessel traffic, other bottom-disturbing activities, and climate change. Fisheries management affects commercial fisheries and recreational fishing in the region through management of sustainable fish stocks and measures to reduce impacts on important habitat and protected species. These management plans include measures such as fishing seasons, quotas, and closed areas, which constrain how the fisheries are able to operate and adapt to change. These management actions can reduce or increase the size of available landings to commercial and recreational fisheries.

Climate change is also predicted to affect U.S. Northeast fishery species (Hare et al., 2016) and may affect commercial and recreational fisheries differently; habitat may increase for some stocks and decrease for others, depending on the targeted species and the ability of fishing regulations to adapt. Changing environmental and ocean conditions (e.g., currents, water temperature), increased storm magnitude or frequency, and shoreline changes can affect fish distribution, populations, and availability to commercial and recreational fisheries.

3.2.11 Recreation and Tourism

Although many recreational and tourism opportunities exist in the inland portions of the coastal counties in Maine, Massachusetts, and New Hampshire, the assessment for this EA focuses on the recreation along the shoreline and offshore that may depend on the ocean setting. Popular recreational activities in and along the Gulf of Maine include wildlife viewing tours, scuba diving, boating, sailing, sea kayaking, surfing, and beach going, including nearshore swimming and scenic enjoyment. Given the regional importance and unique attributes of recreational fishing compared to the other types of recreation and tourism, recreational fishing is discussed as part of the analysis in **Sections 3.2.10** and **3.3.10**.

While the majority of boating activities occur within approximately 20 miles (32 km) of the coast with an increasingly higher density of activities closer to shore, certain recreational activities such as sailing and whale watching can extend farther offshore (Northeast Regional Planning Body, 2016). Multiple open ocean regattas occur within the Gulf of Maine on a recurring basis including the Annual Castine Classic Yacht Race from Castine, Maine to Camden, Maine; the yearly Maine Rocks from Rockland Harbor, Maine to Matinicus Rock, Maine; the biannual Corinthians race from Stonington, Connecticut to Boothbay Harbor, Maine; and the biannual Marblehead to Halifax race from Marblehead, Massachusetts to Halifax, Nova Scotia (Point 97 et al., 2015).

Whale-watching excursions are an important component of the recreational sector operating offshore with more than 22 companies operating in Maine, New Hampshire, and Massachusetts. Trips can range from semi-private charters conducting single day trips for six passengers to larger charters out of hubs like Bar Harbor, Maine that can accommodate up to 400 passengers on three to five trips daily and serve thousands of patrons daily during the July and August season (Point 97 et al., 2015).

The most recent data available from NOAA on ocean-related jobs linked to recreation and tourism are provided in **Table 3-13** for the coastal communities near the Research Lease Area. The recreation and tourism activities described above are anticipated to continue with no discernible change in trends for the timeframe of the Proposed Action.

Table 3-13. Percentage of ocean-related recreation and tourism jobs by county

County/State	Percentage of Ocean-Related Economy Recreation and Tourism Jobs
Maine	56
Cumberland	79.9
Hancock	71.4

County/State	Percentage of Ocean-Related Economy Recreation and Tourism Jobs
Knox	70.9
Lincoln	71.3
Waldo	65.9
Washington	44.7
York	46.9
New Hampshire	41.9
Rockingham	80
Strafford	0
Massachusetts	70.7
Barnstable	92.2
Essex	89.3
Norfolk	64.5
Plymouth	86.1
Suffolk	84.5

Source: NOAA, 2020. Note: No data were reported for Sagadahoc County.

3.2.12 Cultural, Historical, and Archaeological Resources

Several documents report on the potential for submerged cultural resources along the Atlantic Seaboard, including the Gulf of Maine. The findings of these reports are incorporated herein by reference and inform the discussion of archaeological potential and sensitivity below (BOEM, 2012b, 2016, 2021b; NYSERDA, 2017; TRC, 2012). Submerged historic properties that may be within the Research Lease Area include shipwrecks and ancient submerged landform features (ASLFs) (TRC, 2012). ASLFs on the OCS have the potential to contain Native American archaeological sites inundated and buried as sea levels rose at the end of the last Ice Age. In addition to their archaeological potential, ASLFs may be considered traditional cultural properties or tribal resources to Native American tribes in the region, representing places where their ancestors lived. As such, ASLFs are assumed to be cultural resources. Although no submerged pre-Contact era archaeological sites have been identified within the Research Lease Area, it has been theorized that such sites do exist in waters fewer than 197 feet (60 meters) deep (**Figure 3-7**). Portions of the OCS offshore Maine were subaerial before sea levels began to rise following the Last Glacial Maximum, approximately 20,000 years before present. The exposed landscape would have supported human populations from the Paleoindian through Early Archaic periods before sea levels submerged these areas approximately 10,000 years before present (BOEM, 2016). Portions of the OCS closer to shore were submerged later and thus would have supported more recent populations. The TRC (2012) study determined that portions of the seabed with depths shallower than 197 feet (60 meters) are within an area considered to possess high sensitivity for containing submerged indigenous archaeological sites. No areas with depths fewer than 60 meters are present in the Research Lease Area.

Since the advent of colonial expansion into North America, Maine has been the host for commercial fishing and shipping activity. Numerous vessels have plied the waters offshore Maine and, consequently, shipwrecks are a type of historic submerged cultural resource expected to be found within the Gulf of Maine and navigation routes that filter vessel traffic to the ports of New England. Two shipwreck databases (i.e., Automated Wreck and Obstruction Information System, and Electronic Navigation Charts) were consulted to assess the number of shipwrecks in the Gulf of Maine; the number of reported wrecks range from roughly 200 to 300. The frequency of shipwrecks increases dramatically in nearshore areas. The shipwreck databases indicate there are no shipwrecks reported within the Research Lease Area. There are at least 85 reported shipwrecks within areas where benthic disturbances may occur. Examples of other historic-era submerged cultural resources that may be encountered within the Research Lease Area and nearshore are downed aircraft, subsea cables, and other infrastructure (BOEM, 2016, 2021b; NYSERDA, 2017; TRC, 2012).

Historic property types that may be within the onshore affected environment could include districts, sites, buildings, structures, or objects within the viewshed of site characterization and site assessment activities. Klein et al. (2012) includes an overview of common coastal historic property types that could fall within the viewshed of these types of characterization and assessment activities in the Research Lease Area and nearshore. The affected environment for onshore historic properties could include portions of the Maine coastline between Cape Porpoise and Hurricane Island. Coastal properties with ocean views are potentially within the viewshed of site characterization and site assessment activities. Local topography varies from relatively flat beach areas to high cliffs. Development along the coast is generally limited to one- to three-story buildings, and ocean views are generally limited to the first developed block along the coast. Beyond this area, views are blocked by intervening development but may be extended in areas with more relief. Outside of this area, the affected environment may also include resource types with elevated viewing platforms, such as lighthouses or lifesaving stations. Some historic properties have already been identified in Klein et al. (2012); however, additional historic properties are expected to fall within the affected environment.

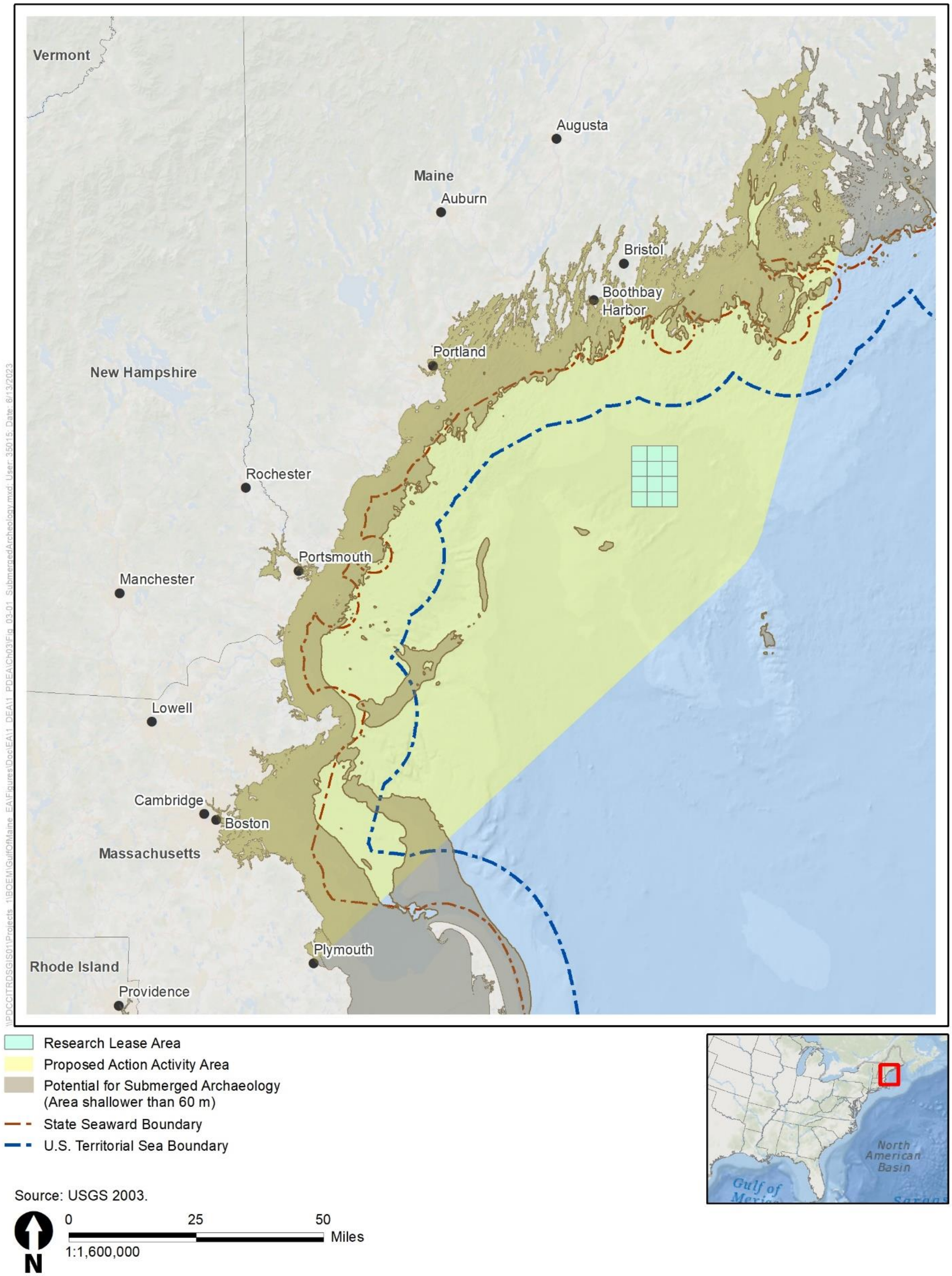

Figure 3-7. Areas with potential for submerged pre-Contact era archaeological sites

3.3 Environmental Consequences

Under the No Action Alternative, BOEM would not issue the research lease. Site assessment activities would not occur within the leased area of the Gulf of Maine. Site characterization activities would be less likely to occur without lease issuance, and baseline conditions would continue as described under the affected environment in **Section 3.2**.

The following sections describe incremental impacts of the Proposed Action by resource.

3.3.1 Air Quality and Greenhouse Gas Emissions

Air emission sources include vessels and aircraft for site assessment activities, including FLiDAR buoy-based acoustic monitoring, and site characterization activities. Vessel traffic due to site characterization surveys and site assessment activities would add to current vessel traffic levels in the Gulf of Maine and to the existing ports used by the survey vessels. The additional vessel activity would be temporary and negligible when compared with existing vessel traffic levels in the region (**Section 3.3.8**). Aircraft activity for digital aerial surveys during site characterization would consist of 12 flights, conducted monthly (**Section 2.2.1**, **Table 2-1**). Impacts from criteria pollutant emissions associated with vessels and aircraft would be localized within the GAA and in the vicinity of vessel or aircraft activity. Estimated potential criteria pollutant emissions and GHG emissions for vessel operations were calculated and the results are provided in **Appendix B**. Estimated annual emissions for Years 1–7 are summarized in **Appendix B**. The numbers of vessel trips and associated emission calculations, along with the assumptions used to complete the calculations, are also provided in **Appendix B**. Air emissions from onshore activities are assumed to be negligible in comparison with the existing activities because existing port facilities would be utilized, and no expansion would be needed for these facilities to accommodate the Proposed Action.

Major source thresholds[3] for the counties closest to the Research Lease Area are as follows:

- 100 tons/year of NO_X (O_3 precursor)
- 50 tons/year of VOCs (O_3 precursor)
- 100 tons/year of CO
- 100 tons/year of PM
- 100 tons/year of SO_2

As indicated in **Appendix B**, estimated annual potential criteria pollutant emissions are expected to be lower than major source thresholds and are not expected to lead to any violation of the NAAQS.

3.3.1.1 Non-Routine Events

Non-routine events that could affect air quality consist of the recovery of lost equipment through additional vessel traffic. Traffic associated with non-routine activities would likely be from a single vessel for a short duration.

[3] Major source thresholds are defined in the Clean Air Act for purposes of permitting stationary emission sources on land. The major source thresholds do not apply to the Proposed Action but are used here as screening levels for assessing potential air quality impacts.

3.3.1.2 Conclusion

As shown in **Appendix B**, criteria pollutant concentrations due to emissions from the Proposed Action are not expected to lead to any violation of the NAAQS. The main impact drivers stem from surveys to support construction of planned wind projects. Although the emissions estimates from the Proposed Action are measurable, they would not be distinguishable from other air emissions onshore or offshore; therefore, impacts of criteria pollutant emissions (**Appendix B**) associated with the Proposed Action are expected to be **negligible** even without mitigation.

3.3.2 Water Quality

The routine activities associated with the Proposed Action that could affect coastal and marine water quality include vessel discharges (including bilge and ballast water and sanitary waste), geotechnical and benthic sampling and other seafloor disturbances that could generate suspended sediment, and installation and removal of the FLiDAR buoy.

Impacts on coastal and marine waters from vessel discharges would likely be of short duration and have little to no effect on water quality within the GAA with adherence to regulations governing discharges. These undetectable changes in water quality would not contribute to changes in water quality classifications of marine and estuarine waters within the Gulf of Maine. The Proposed Action would have no effects on runoff or onshore discharge into harbors, waterways, coastal areas, or the ocean environment. Most site characterization and site assessment activities would be covered by USACE Nationwide Permit Numbers 5 and 6, which were developed under Section 404 of the Clean Water Act and Section 10 of the River and Harbors Act to provide a streamlined evaluation and approval process for certain activities that have minimal adverse environmental impact, both individually and collectively. Sediment disturbance resulting from geotechnical investigations, benthic sampling, bottom and lobster trawl surveys, installation of the FLiDAR buoy, and vessel anchoring would temporarily increase local turbidity from localized sediment disturbances, which individually are not anticipated to exceed approximately 32 square feet (ft^2) (3 square meters [m^2]), but these impacts would be short term and are not anticipated to result in any detectable impact on water quality within the Research Lease Area or other areas surveyed for potential export cable routes and wet storage.

3.3.2.1 Non-Routine Events

Non-routine events include the recovery of lost survey equipment and/or spills. The recovery of lost survey equipment may also disturb sediment, similar to the Proposed Action. Sediment disturbance and resultant turbidity associated with recovering lost equipment would be temporary and localized.

Impacts may also occur from spills. However, as mentioned in **Section 2.2.2.3**, based on the size of a typical spill, it would be expected to dissipate very rapidly and then evaporate and biodegrade within a day or two (at most), limiting the potential impacts to a localized area for a short duration. Additionally, any spills related to oil are required to be cleaned up pursuant to the Clean Water Act, the Oil Pollution Act, and the National Oil and Hazardous Substances Pollution Contingency Plan.

3.3.2.2 Conclusion

Impacts on coastal and marine water quality from routine vessel discharges and sediment disturbance from sampling and anchoring, as well as non-routine activities such as recovery of lost equipment and spills, would be **negligible** even without mitigation because any changes to water quality would be small in magnitude, highly localized, and transient.

3.3.3 Benthic Resources

The approach of this analysis is to focus on the potential IPFs from routine site characterization and site assessment activities expected to take place once the wind energy research lease is issued. The routine activities associated with the Proposed Action that would affect benthic resources include noise from G&G vessels, survey equipment, and seafloor disturbance from the site assessment and characterization activities, along with the anchoring of the FLiDAR buoy, and associated anchor drag. Increased vessel presence within the Research Lease Area and surrounding Gulf of Maine would also lead to an increased risk for routine vessel discharges, with the potential for secondary impacts from the possible release of invasive species.

Underwater noise may be pulsed at specific frequencies (e.g., active acoustic survey equipment) or be broad spectrum and continuous (e.g., from project-associated marine transport vessels). Vessels and aircraft conducting site assessment and site characterization activities would also contribute to noise above the ocean surface. The increase in noise would come from increased vessel traffic as well as sound-emitting sources used during site assessment and characterization activities. The two primary components of underwater noise impacts include pressure and particle motion. Pressure can be characterized as the compression and rarefaction of the water as the noise wave propagates through it. Particle motion is the displacement, or back-and-forth motion, of the water molecules that create compression and rarefaction.

Site assessment surveys would include the use of high-resolution geophysical (HRG) surveys, sparkers, sub-bottom profilers, and other active acoustic sources (non-air gun) to identify benthic features. Survey gear such as multibeam echosounders, side-scan sonars, and some sub-bottom profilers use frequencies above the hearing range identified for most fish and invertebrates (approximately 2 kilohertz [kHz]) (Hogan et al., 2023; Popper and Hawkins, 2018). Therefore, the planned acoustic surveys are anticipated to affect the behavior of benthic species.

To date, research on invertebrate response to vessel noise is inconclusive (Carroll et al., 2017; Popper et al., 2022). Some crustaceans seem to increase oxygen consumption (crabs: Wale et al., 2013) or show increases in stress indicators (spiny lobsters: Filiciotto et al., 2014). Other species (American lobsters and blue crabs) showed no difference in stress indicators but spent less time handling food, defending food, and initiating fights with competitors (Hudson et al., 2022). While there does seem to be some evidence that certain behaviors and stress biomarkers in invertebrates could be negatively affected by vessel noise, it is difficult to draw conclusions from this work because it has been limited to the laboratory and in most cases did not measure particle motion as the relevant cue. Based on the available literature and infrequent and dispersed nature of the vessel traffic, minimal impacts on behavior or stress response of benthic communities are anticipated.

The primary potential impacts on benthic organisms include crushing or smothering by survey equipment and anchors or anchor chain, or smothering by sediment displaced by disturbance activities. Injury or mortality of benthic organisms could occur from contact with vessel anchors, anchor chain, or survey equipment, which could crush benthic organisms or lead to fatal injuries. Mobile species, such as lobsters and crabs, may be able to avoid lethal impacts but would experience temporary habitat displacement.

The range of sediment suspension as a result of buoy deployment and removal is expected to be limited and would be based on the sediment composition, direction, and flow rate of the water. Anchor drag around the buoy would increase impacts, potentially resulting in scarring or additional damage to benthic habitats. The details of geotechnical surveys have not been finalized but BOEM estimates that a few hundred geotechnical/benthic samples would be collected for site characterization, each with a general footprint on the order of several m^2 per sample. Disturbance from installation of the FLiDAR buoy could result in a maximum impact area of 32 ft^2 (3 m^2) from the gravity-based anchor. There would be several meters of anchor chain on the seabed that can be lifted or dragged in response to the sea conditions. As only one FLiDAR buoy is proposed, the total disturbed area is anticipated to be small and localized.

Recovery of the soft-bottom habitats could take a few months to a few years depending on the substrate composition, with sandy substrates recovering more quickly than silt and clay. However, recovery is expected to take longer in the complex or gravel habitats based on studies of the impacts within Georges Bank (Collie et al., 2005; Kaiser et al., 2002; Kaiser et al., 2006). Empirical studies of gravel habitat communities on the Northeast Peak of Georges Bank subject to strong tidal currents and a well-mixed water column have recovery times in excess of 10 years based on time-series monitoring (Collie et al., 2005; Tamsett et al., 2010). Benthic disturbance in complex or sensitive habitats including coral gardens would have a greater impact and require a longer timeframe for recovery (Brooks et al., 2006; Kritzer et al., 2016; Lindholm et al., 2004). As very slow-growing species, deep-sea corals often only grow a few millimeters per year, which means that damaged coral groves will require anywhere from several decades to hundreds of years to regenerate (NOAA Fisheries, 2022a).

The installation of a FLiDAR buoy gravity anchor on soft substrates would introduce hard substrate to the Research Lease Area that could be colonized by benthic invertebrates. The additional hard surfaces would allow for recruitment of hard-bottom species and the potential attraction of mobile invertebrates (e.g., crabs, lobsters) and pelagic and demersal fish (Degrear et al., 2020).

Increases in routine vessel discharge would be expected due to an increase in vessel activity within the regional waters and ports. All vessels involved in site assessment and characterization activities are required to comply with existing state and federal regulations related to ballast and bilge water discharge, including USCG ballast discharge regulations (33 CFR 151.2025) and EPA National Pollutant Discharge Elimination System Vessel General Permit standards. Compliance with these measures aims to prevent the release of contaminated water discharges. An estimated 1,042 total vessel trips would occur in relation to the site assessment and characterization of the Research Lease Area.

According to the Maine Port Authority, the Port of Portland is the largest foreign inbound tonnage transit port in the United States, the largest tonnage port in New England, and the largest oil port on the U.S. East Coast, with trans-oceanic shipping (i.e., container ships) representing the most likely means of introduction of invasive species (Trott et al., 2020). The aorid amphipod *Grandidierella japonica* and an encrusting bryozoan (*Cribrilina* [*Juxtacribrilina mutabilis*]) were identified invasive species found in the Gulf of Maine in 2018 eelgrass surveys in Casco Bay (Trott and Enterline, 2019). There is a potential for introduction of invasive species through the discharge of ballast water; however, many if not all cruises will begin in local ports, thereby reducing the likelihood of the introduction of new invasive species to a negligible impact. Invasive species already present in the Gulf of Maine such as the green crab (*Carcinus maenas*) would continue to widen their northern range with warming waters (Fitzgerald, 2021).

3.3.3.1 Non-Routine Events

Non-routine events that could potentially have benthic impacts include the process to recover lost survey equipment, collisions/allisions, and fuel spills. Most commonly the recovery of lost equipment is accomplished by dragging grapnel lines in hopes of catching the loose gear and bringing it to the surface for recovery. Often this process involves multiple passes within a given area, which can lead to substantial seafloor disturbance in a concentrated area. Environmental conditions and the cost of the gear would guide decisions about the level of effort for recovery, determining the area of impact and time expended. Collisions occur when two or more vessels strike each other, while allisions would occur when a vessel strikes the proposed FLiDAR buoy. The risk of either of these scenarios is low, especially with light vessel traffic within the Research Lease Area. Should an incident occur, it could also lead to accidental releases. Accidental releases in this scenario would likely consist of fuels, lubricating oils, and other petroleum compounds that tend to float in seawater and would therefore be unlikely to affect benthic environments in offshore waters, although they could harm organisms in nearshore shallow habitats.

3.3.3.2 Conclusion

The primary effects of routine activities associated with the Proposed Action would be crushing from direct contact with the gear, smothering by elevated sedimentation levels, and resuspension. The recovery of affected benthic communities would vary based on habitat and the degree of impact. Overall, the impacts from site characterization and site assessment activities on benthic resources in the Research Lease Area are expected to be **negligible** even without mitigation because the maximum area affected by geotechnical investigations, benthic sampling, bottom and lobster trawl surveys, installation of the one FLiDAR buoy, and vessel anchoring would be small, with no population-level effects anticipated.

3.3.4 Finfish, Invertebrates, and Essential Fish Habitat

Previous lease issuance EAs (BOEM, 2021b) and the Atlantic G&G Final Programmatic Environmental Impact Statement (BOEM, 2014a) identified potential impacts on fish resources and EFH that could occur in wind lease areas during site characterization and site assessment. Although these previous documents do not specifically address the Gulf of Maine, many species occur across all areas and therefore information presented in those analyses is summarized and incorporated by reference in this EA. For reasons summarized below and with consideration of the previous EAs (BOEM, 2021b) and the Atlantic G&G Final Programmatic Environmental Impact, these IPFs are not discussed further in this analysis:

- Impacts from acoustic sound sources from HRG surveys and geotechnical exploration are expected to range from **negligible** to **minor**. Of the sources that may be used in geophysical surveys for offshore wind, only a handful (e.g., boomers, sparkers) emit sounds at frequencies that are within the hearing range of most fishes and invertebrates. This means that the parametric sub-bottom profilers utilized under the Proposed Action would not be audible, and thus would not affect these taxa. For the sources that are audible (i.e., the ultra-high-resolution seismic imager included under the Proposed Action), it is important to consider other factors such as source level, beamwidth, and duty cycle (Ruppel et al., 2022). Boomers, sparkers, and hull-mounted sub-bottom profilers have source levels close to the threshold for injury for pressure-sensitive fishes, so unless a fish was within a few meters of the source, injury is highly unlikely (Crocker and Fratantonio, 2016; Popper et al., 2014). Behavioral impacts could occur over slightly larger spatial scales. For example, if one assumes a sound pressure level (SPL) threshold of 150 decibels (dB) referenced to 1 micropascal (re 1 μPa) for behavioral disturbance (Greater Atlantic Regional Fisheries Office, 2020), sounds with source levels of 190 dB re μPa meter would fall below this threshold several hundred meters from the source (assuming 15 × log[R] propagation loss). This means that the lowest-powered sparkers, boomers, and bubble guns would not result in behavioral disturbance beyond this distance, and this range would be even smaller for slightly quieter sources like towed sub-bottom profilers (Crocker and Fratantonio, 2016). It should be noted that these numbers are reported in terms of acoustic pressure because there are currently no behavioral disturbance thresholds for particle motion. It is expected that behavioral impact ranges would be even smaller for particle motion-sensitive species, including invertebrates. Because most HRG sources are typically "on" for short periods with silence in between, only a few "pings" emitted from a moving vessel towing an active acoustic source would reach fish or invertebrates below, so behavioral effects would be intermittent and temporary. Impacts would result in temporary and spatially limited changes in behavior and displacement, particularly for those species capable of hearing in the high-frequency range such as herrings. Additionally, no significant adverse effects on EFH for any pelagic species are anticipated.

- Impacts from vessel traffic and concomitant noise are expected to be **negligible**. Noise from vessels and equipment (other than the site assessment- and site characterization-related equipment discussed in this section) would be temporary and spatially limited from the estimated 1,042 vessel roundtrips over an approximately 6-year period, which includes installation of the FLiDAR buoy and later subsequent removal from the Research Lease Area. Any potential impacts could result in behavioral changes. Vessel and equipment noise associated with the Proposed Action would be inconsequential relative to existing vessel noise in the GAA.

Installation of the single gravity anchor associated with the FLiDAR buoy may cause a punctuated initial increase in local suspended sediments and displacement of demersal finfish and invertebrates and the EFH of managed species within the footprint of the gravity anchor and related anchor chain sweep. These impacts would be limited to the immediate surrounding area and short in duration. The anchor would encompass 32 ft^2 (3 m^2) with some added area related to the anchor chain sweep. Any infaunal invertebrates or burrowing finfish (flatfish or sand lances) within the impact footprint of the anchor may experience direct mortality and loss of benthic habitat during the deployment period (24 months). Impacts related to the anchor chain sweep would not be as severe as those of the anchor but would be repeated throughout the buoy deployment as the anchor chain moves with the effects of currents and wind on the connected buoy. Sessile (immobile) marine invertebrates, including molluscan shellfish, would be lost (buried or crushed) in the footprint of the anchor and/or displaced and injured by the anchor chain. Although the EFH managed species Atlantic sea scallops are mobile shellfish, it is conservatively assumed they would not be able to avoid sudden deployment of an anchor; as such, for this analysis, they are considered to be sessile. The amount of habitat temporarily displaced or lost in the area would be small compared to the amount of habitat available in the surrounding Research Lease Area, and the recovery of affected habitat to pre-disturbance levels is expected to take between a few months to a few years, depending on the degree of impact and specific composition of the benthic substrate and associated benthic community. Fish and mobile invertebrates are expected to move to the surrounding areas during the operational phase of the FLiDAR buoy. The gravity anchor could adversely affect EFH; however, the anchor structure would have a small footprint (32 ft^2 [3 m^2]) plus a halo of intermittently disturbed benthic substrate up to several meters in length related to the anchor system. The impact from the anchor footprint and anchor sweep is not expected to significantly affect the quality or quantity of EFH within the Research Lease Area. The impact related to anchor installation and presence during the 24-month operation of the FLiDAR buoy systems would be temporary and the seafloor affected could potentially return to pre-existing conditions without mitigation once the buoy and anchoring system is removed (Dernie et al., 2003). Therefore, impacts from habitat loss due to installation, operation, and decommissioning (i.e., removal) of a FLiDAR buoy for a 24-month duration on finfish, invertebrates, and EFH would be localized and short term.

The installation of a FLiDAR buoy gravity anchor on soft substrates would introduce hard substrate to the Research Lease Area that could be colonized by benthic invertebrates. Fish species that prefer hard-bottom or complex habitats would likely be attracted to anchors, potentially increasing local fish abundance. Additionally, the buoy and anchor array themselves may provide habitat for pelagic species such as king mackerel and some schooling species (e.g., herrings, anchovies, Atlantic mackerel). Changes in species composition and community assemblage are expected only at the localized areas surrounding the anchor and buoy; no population-level effects on finfish, invertebrate populations, or EFH are expected because only a single buoy system would be installed.

Biological surveys, primarily fishery surveys, would likely result in some direct mortality of finfish and invertebrates. SOCs and mitigation measures listed in Appendix D include measures to avoid or minimize impacts on ESA-listed species during fishery surveys. Nevertheless, sub-sampling and other trauma is expected to result in some mortality. This mortality is anticipated to be undetectable within the overall fishery management regime described in **Section 3.2.10**.

A component to the biological sampling that may result in an adverse effect involves entanglement from nets to be utilized during biological sampling efforts (i.e., shrimp trawls, gillnets, and lobster pot trawls [**Table 2-1**]). Entanglement would most likely occur during net or trap deployment and retrieval or when gear and tackle are slack and able to wrap or ensnare larger finfish (e.g., bluefish, bluefin tuna), foraging sharks (e.g., spiny dogfish, blue sharks, common thresher shark, porbeagle shark), or the slow-moving filter-feeding pelagic basking shark. The potential for this impact is very low but not nonexistent.

Although the overall impacts on finfish and invertebrates from biological surveys are anticipated to be negligible, BOEM recognizes that some fishery surveys could affect ESA-listed species. BOEM is preparing a Section 7 ESA consultation to address these impacts to minimize or eliminate, as best possible, impacts on ESA-listed species. Project design criteria and best management practices that would be applied to avoid adverse impacts on ESA-listed species are listed in Appendix A of the NMFS BA (BOEM, 2023b).

Geotechnical and biological benthic sampling may affect the Summer Flounder HAPCs (**Figure 3-2**), areas within the GAA that juvenile Atlantic cod may utilize and within the Cod Protection Closures HMAs. These designated areas (summer flounder and juvenile Atlantic cod nearshore habitats [structurally complex, i.e., eelgrass, algae, rocky benthic habitats] and Cod Protection Closures HMAs) could be affected during G&G and biological survey efforts used to identify and characterize potential future export cable corridors and inshore wet storage and project staging areas. Because the juvenile Atlantic cod HAPC is designated to Plymouth Bay (**Figure 3-2**), it is unlikely that this HAPC would be directly affected by the implementation of this Research Lease and concomitant activities (geotechnical and biological benthic sampling). However, habitats with the same characteristics near the GAA and within the export cable corridor could be affected through these survey operations. The Cod Protection Closures are only restricted during the May 1 through June 31 closure periods (NOAA Fisheries, 2022b). The total number of geotechnical/benthic samples that would be taken within these areas by the lessee for site characterization would be determined at a later date. However, geotechnical and benthic sampling that could occur within inshore areas (including within HAPCs) associated with the potential transmission cable routes would be a small number of samples (fewer than 15 to 20 benthic grab or geotechnical cores) within a very narrow corridor of approximately 98 feet (30 meters). The physical bottom-sampling footprint for each collection is dependent upon the sampling device but as an example the Smith McIntyre benthic grab collects a surface sediment sample of approximately 1.07 ft^2 (0.1 m^2). The impacts of the small footprint of the samples within the inshore area along potential future project easements for export cables and wet storage and the project staging area are not expected to result in the loss of any ecosystem function within the Summer Flounder HAPC.

Vessels to be utilized for the site assessment and characterization activities are required to adhere to existing Maine Department of Environmental Protection and federal regulations related to ballast and bilge water discharge, including USCG ballast discharge regulations (33 CFR 151.2025) and EPA National Pollutant Discharge Elimination System Vessel General Permit standards, both of which aim to prevent the release of contaminated water discharges. Vessel operations related to the Research Lease Area and associated survey and transit areas are estimated to require 1,042 vessel roundtrips over a 6-year period, which would only slightly increase the routine vessel discharges within the Research Lease Area and potential future project easements. As such, routine releases from Research Lease Area site assessment and characterization activities related to the Proposed Action would not be expected to contribute appreciably to overall impacts on finfish, invertebrates, and EFH of managed within the GAA.

3.3.4.1 Non-Routine Events

Non-routine events that could potentially have impacts on finfish and invertebrate populations and EFH include recovery of lost survey equipment. The extent of impacts would depend on the type of lost equipment and the chance of recovery. The larger the equipment lost or the more costly it would be to replace would dictate the number of attempts made at recovery, affecting the size of the resultant impact area and time spent searching. Additionally, where the equipment is lost would dictate the impact on other resources. When equipment is not able to be retrieved, bottom disturbance may occur from cutting/capping activities or from the equipment itself as it is carried away by currents. As described in the previous section on entanglement, the potential for impacts on finfish and invertebrate populations and EFH resulting from the recovery of lost equipment is very low and would be minimized through project design criteria and best management practices but is not nonexistent.

3.3.4.2 Conclusion

Overall, impacts from site characterization and site assessment activities on finfish and shellfish populations and EFH in the GAA are expected to be **negligible** because primary impacts on this resource are disturbance related and no population-level effects are anticipated for the associated finfish and invertebrates or their EFH and on any ESA-listed species due to the relatively small and localized areas that could be disturbed in the course of geotechnical investigations, benthic sampling, bottom and lobster trawl surveys, installation and removal of the FLiDAR buoy, and vessel anchoring. Furthermore, implementation of SOCs and mitigation measures (**Chapter 5**) would minimize potential impacts on finfish and shellfish populations.

3.3.5 Marine Mammals

Factors that could potentially have an impact on marine mammals from the Proposed Action include acoustic effects from site characterization surveys, vessels, and equipment noise; benthic habitat effects; vessel strike; and entanglement risk due to fisheries monitoring surveys. BOEM has developed SOCs and mitigation measures that would apply to site assessment and site characterization activities, as applicable (**Chapter 5**). These include measures designed to prevent or reduce possible impacts on marine mammals during activities associated with the Proposed Action and are hereby incorporated by reference for the analysis below.

Detailed discussions on underwater sound and its importance to marine mammals and their hearing capabilities can be found in the NMFS BA (BOEM, 2023b). Site assessment and characterization surveys that produce noise that could affect marine mammals include vessel activities, geotechnical surveys, and HRG surveys (**Table 2-1**). While the geophysical reconnaissance surveys would also use geophysical survey equipment, the proposed equipment all has operating frequencies (greater than 180 kHz) above relevant marine mammal primary hearing sensitivities or produces very narrow beamwidths, so noise from equipment is unlikely to be detectable beyond a few meters from the sources for most marine mammals; as such, no notable effects are expected. The noise sources under the Proposed Action would be all either non-impulsive sources or impulsive sources that are highly directional and produce low noise levels; therefore, the likelihood of auditory injury such as permanent threshold shift (PTS) is extremely low due to the nature of these noise sources (BOEM, 2023b). Additionally, all survey activities would follow the SOCs and mitigation measures described in **Chapter 5**, which would further limit the likelihood of PTS being realized for any marine mammal species. Therefore, this IPF is not discussed further in this section.

Currently, the recommended behavioral disturbance thresholds for marine mammals are provided as unweighted SPL to assess behavioral impacts (NMFS, 2023b). Although these criteria do not differentiate between marine mammal hearing groups like the PTS thresholds, they do differentiate between the types of sound sources and are applied as follows:

- SPL 120 dB re 1 µPa for the potential onset of behavioral disturbance from a *non-impulsive*, *continuous* source of sound (e.g., vessel noise)
- SPL 160 dB re 1 µPa for the potential onset of behavioral disturbance from an *impulsive* or *non-impulsive, intermittent* source (e.g., HRG surveys, geotechnical coring)

Behavioral reactions are expected to occur over a wide spectrum of variable responses, depending on the species and source type.

Vessel sound is characterized as low frequency, typically below 1,000 Hertz (Hz), with peak frequencies between 10 and 50 Hz; non-impulsive rather than impulsive like impact pile driving; and continuous, meaning there are no substantial pauses in the sounds that vessels produce. Noise levels vary based on the type of vessel (BOEM, 2023f), but generally underwater source levels can range from 177 to 200 dB re 1 µPa at 1 meter for large vessels and barges (Erbe et al., 2019; McKenna et al., 2012) and between 150 and 180 dB re 1 µPa at 1 meter for smaller crew vessels (Kipple and Gabriele, 2003, 2004). Parsons et al. (2021) reviewed literature for the source levels and spectral content of vessels fewer than 82 feet (25 meters) in length, a category often not addressed in vessel noise assessment measurements, and found reported source levels in these smaller vessels to be highly variable (up to 20 dB difference); however, an increase in speed was consistently shown to increase source levels while vessels at slower speeds were shown to emit low-frequency acoustic energy (less than 100 Hz) that is often not characterized in broadband analyses of small vessel sources.

Effects from vessel noise during both site assessment and characterization activities would predominantly be behavioral responses and potential auditory masking. A detailed review of the effects of vessel noise on specific marine mammal groups is provided in Erbe et al. (2019), but a high-level summary of the potential effects is provided for this discussion. A comprehensive review of the literature (Erbe et al., 2019; Mikkelsen et al., 2019; Richardson et al., 1995; Sprogis et al., 2020; Williams et al., 2022) revealed that most of the reported adverse effects of vessel noise and presence are changes in behavior, although the specific behavioral changes vary widely across species. Physical behavioral responses include changes to dive patterns, disruptions to resting behavior, increases in swim velocities, and changes in respiration patterns (Finley et al., 1990; Mikkelsen et al., 2019; Nowacek et al., 2006; Sprogis et al., 2020; Williams et al., 2022). Behavioral disturbances that alter an animal’s foraging behavior can have a direct effect on an animal’s fitness, as has been observed in porpoises (Wisniewska et al., 2018) and killer whales (Holt et al., 2021) in response to vessel noise. Physical stress has also been demonstrated in baleen whales in response to low-frequency anthropogenic noise by Rolland et al. (2012).

Some marine mammals may change their acoustic behaviors in response to vessel noise, either due to a sense of alarm or in an attempt to avoid masking, by altering the frequency characteristics of their calls (Castellote et al., 2012; Lesage et al., 1999), changing the number of discrete calls produced in a given time period (Azzara et al., 2013; Buckstaff, 2006; Guerra et al., 2014), or ceasing vocal activity completely (Finley et al., 1990; Tsujii et al., 2018). Some species may change the duration of vocalizations (Castellote et al., 2012) or increase call amplitude (Holt et al., 2009) to avoid acoustic masking from vessel noise.

Acoustic masking is another effect of long-term anthropogenic noise, such as vessel traffic, and is detailed further in BOEM, 2023b. The Proposed Action is unlikely to result in any long-term acoustic masking given the relatively low volume of vessels required for the site assessment and characterization activities (**Section 2.2**) compared to existing vessel traffic in the region (**Section 3.2.9**) and the duration of the vessel transits under the Proposed Action. Additionally, although behavioral responses may occur in response to vessels transiting the Gulf of Maine, these responses are unlikely to result in physiological effects due to stress responses or impacts on foraging, migrating, or mating behavior given the low volume of vessel traffic under the Proposed Action and relatively short duration (**Section 2.2**). Furthermore, the vessel speed reductions included in the SOCs and mitigation measures (**Chapter 5**) would help reduce the level of noise produced by project vessels (ZoBell et al., 2021). Overall, the behavioral disturbances that could result from exposure to vessel noise would not disrupt the normal routine function of marine mammals in the Gulf of Maine and would therefore be **minor**.

Geotechnical surveys that employ coring equipment may produce non-impulsive, intermittent, low-frequency noise (less than 3 kHz) with a back-calculated source level, expressed as SPL, estimated to be 187 dB re 1 µPa at 1 meter (Chorney et al., 2011). This noise is within the hearing range of most marine mammals, and although the estimated source levels would exceed the behavioral disturbance threshold of 160 dB re 1 µPa, they would only be exceeded within approximately 65 feet (20 meters) of the source using spherical spreading loss equations. Therefore, while geotechnical survey noise may be detectable it is unlikely to result in measurable behavioral effects for any marine mammal species and potential impacts therefore would be negligible.

The proposed HRG surveys using the sub-bottom profiler and ultra-high-resolution seismic imaging equipment may produce noise levels within hearing frequencies and above regulatory hearing thresholds for some marine mammals (Crocker and Fratantonio, 2016; Ruppel et al., 2022). The proposed sub-bottom profiler would be a parametric system with a highly directional beamwidth and operational frequencies between 30 and 115 kHz, which is classified as a non-impulsive, intermittent source. The ultra-high-resolution seismic imaging system has not been specified at this time, but it would fall under the impulsive source category with operational frequencies estimated to be less than 5 Hz.

In the BA for Data Collection and Site Survey Activities for Renewable Energy on the Atlantic OCS (BOEM, 2021c), estimated distance to the behavioral threshold was a maximum of 1,640 feet (500 meters) for marine mammals during use of sparker systems operating at the highest power, which is expected to be louder than the sub-bottom profiler and ultra-high-resolution seismic imaging systems proposed for Proposed Action HRG surveys. Therefore, this represents a maximum potential area of effect that can be used to assess the risk of impacts on marine mammals from the Proposed Action. However, HRG surveys would occur for less than a 1-year period under the Proposed Action, with sources operational for up to 200 days (**Section 2.2**). Although some geophysical sources can be detected by marine mammals and may exceed the thresholds, given several key physical characteristics of the sound sources, including source level, frequency range, duty cycle, and beamwidth, most HRG sources are unlikely to result in behavioral disturbance of marine mammals, even without mitigation (Ruppel et al., 2022). This finding is further supported by Kates Varghese et al. (2020), who found no change in three of four beaked whale foraging behavior metrics (i.e., number of foraging clicks, foraging event duration, click rate) in response to a 12-kHz multibeam echosounder; Vires (2011), who found no change in Blainville's beaked whale click durations before, during, and after a scientific survey with a 38-kHz EK-60 echosounder; and Quick et al. (2016), who found that short-finned pilot whales did not change foraging behavior but did increase their heading variance during use of an EK-60 echosounder. Conversely, Cholewiak et al. (2017) found a decrease in beaked whale echolocation click detections during use of an EK-60 echosounder. Given these reports with the proposed equipment types and short duration of the HRG surveys, prolonged disruptions to foraging or mating behavior are not expected. Given the small distances to the behavioral disturbance thresholds and the mitigation included in the Proposed Action (**Chapter 5**), impacts would not disrupt the normal or routine functions of marine mammals and would therefore be **minor**.

Potential impacts on marine mammals include strikes from vessels used during site assessment and site characterization activities. BOEM estimates that the total number of vessel trips from routine activities under the Proposed Action would be approximately 1,042 vessel roundtrips over an approximately 6-year period. While vessel traffic anticipated as a result of the Proposed Action would add to the existing vessel traffic in the region, the estimated number of roundtrips over a 6-year span would be a relatively small amount of activity (**Section 3.3.8**). BOEM's required implementation of the SOCs and mitigation measures for site assessment and site characterization activities (**Chapter 5**) includes measures designed to minimize potential vessel strikes to marine mammals. Furthermore, BOEM and USACE (2013) concluded that, during site characterization and site assessment activities, the potential for construction- and maintenance-related vessel strike to marine mammals is extremely low. In addition to the low risk of strikes, typical site assessment and site characterization surveys are generally conducted at slow operational speeds (typically 4 to 6 knots), further reducing the risk of a strike by allowing observers to spot a marine mammal within the vessel strike zone and take evasive maneuvers, if needed, to avoid a strike. Transits, however, may be conducted at higher speeds (10 knots or greater), though all vessels would comply with all active and applicable NOAA NARW vessel speed restrictions (73 *Federal Register* 60173).

The potential effect of a vessel strike on marine mammal populations is considered severe in intensity because potential receptors include listed species (e.g., NARW) and other large baleen whales (e.g., fin and humpback whales), which have a higher susceptibility to vessel strikes compared to certain odontocetes (excluding sperm whales) and pinnipeds; most odontocetes and pinnipeds are considered to be at low risk for vessel strikes due to their swimming speed and agility in the water. Effects from vessel strikes range from minor injuries to mortality, depending on the species and severity of the strike.

The contribution of vessel traffic under the Proposed Action would represent only a small portion of the overall annual increases in vessel traffic in the region. Potential impacts on marine mammals from vessel strikes during site assessment and site characterization activities are therefore expected to be minor because of the low probability of such an event, the application of SOCs and mitigation measures, and the relatively low level of vessel traffic expected under the Proposed Action. However, if a low-probability strike were to occur, this impact would be minor for pinnipeds and odontocetes because population-level effects are unlikely although consequences to individuals would be detectable and measurable; moderate for mysticetes other than the NARW because vessel strike would result in long-term consequences to individuals or populations that are detectable and measurable, although populations are expected to sufficiently recover; and major for the NARW, as the death of a single individual could lead to severe population-level consequences that compromise the viability of the species. However, the likelihood of vessel strike for all marine mammal species, including the NARW, is considered very low given the expected limited total extent and duration of Proposed Action activities and the application of vessel strike avoidance measures as part of the SOCs and mitigation measures. Therefore, the overall impact on marine mammals from vessel strikes under the Proposed Action is expected to be minor.

Any sampling that utilizes in-water gear may pose an entanglement or capture risk to marine mammals. Biological and fisheries monitoring surveys for the Proposed Action would result in an increase in the amount of fishing gear in the water, which would likewise result in an increased entanglement risk for marine mammals. All marine mammal species are susceptible to entanglement from fishing gear, although the impact is particularly pronounced for the NARW. Trap and pot type gear poses the highest risk for mysticete entanglement, while trawl and gillnet fishing gear poses greater risk to smaller odontocetes and pinnipeds.

Proposed Action-related fisheries monitoring surveys would be of limited frequency and duration (**Table 2-1**). The contribution of fisheries sampling gear under the Proposed Action would represent a very small portion of the overall and ongoing fishing activity in the Gulf of Maine (**Section 3.3.9**). The potential for marine mammals to interact with and become entangled in Proposed Action–related monitoring survey fishing gear is therefore low. BOEM recognizes that some fishery surveys could affect ESA-listed species and is preparing a Section 7 ESA consultation to address these impacts to minimize or eliminate, as best possible, impacts on ESA-listed species. However, if an entanglement or entrapment were to occur, the impacts of gear utilization would be minor for mysticetes (other than the NARW), odontocetes, and pinnipeds because impacts on individuals would be detectible and measurable but would not lead to population-level effects; and major for the NARW because a single entanglement could lead to severe population-level effects that compromise the viability of the species. However, the likelihood of marine mammal entanglement in biological monitoring gear is considered low given the expected limited total extent and duration of monitoring surveys considered under the Proposed Action and with implementation SOCs and mitigation measures designed to reduce potential impacts on protected species, including marine mammals. Therefore, the overall impact on marine mammals from entanglement under the Proposed Action is expected to be minor.

Potential impacts on marine mammals during FLiDAR buoy installation, operation, and decommissioning include associated vessel traffic (considered above for vessel strike risk), possible entanglement in the mooring, and temporary disturbance of benthic habitat. The installation and presence of a FLiDAR buoy and its associated mooring would result in a temporary disturbance and a loss of benthic habitat over a very small area within the GAA. A single FLiDAR buoy within the Gulf of Maine is unlikely to alter distribution of any forage species for marine mammals. The anchor chain sweep for the buoy mooring is expected to denude a small area (i.e., several square meters) around the anchor, but the area of benthic habitat loss would be very small compared to the available habitat in the Gulf of Maine and is not expected to have any measurable or detectable negative impact on foraging abilities of marine mammals. Additionally, high tension of the buoy chain for the FLiDAR buoy would reduce risk of entanglement (Anderson, 2021; BOEM and USACE, 2013). Potential impacts on marine mammals from FLiDAR buoy installation and operation are expected to be negligible. During FLiDAR buoy removal, disturbance of the sediment can cause elevated levels of turbidity, which may negatively affect prey items in a localized area. However, impacts would be of lower magnitude than those resulting from installation activities and are expected to be negligible. Potential impacts on marine mammals due to loss of habitat, changes to prey abundance, and distribution from installation of the FLiDAR buoy are expected to be non-measurable and negligible.

3.3.5.1 Non-Routine Events

Non-routine events (**Section 2.2.2**) that could affect marine mammals include spills and recovery of lost equipment. Marine mammals are susceptible to the effects of contaminants from pollution and spills, which can lead to issues in reproduction and survivorship and other health concerns (e.g., Hall et al., 2018; Jepson et al., 2016; Murphy et al., 2018; Pierce et al., 2008). All vessels would be expected to comply with USCG requirements relating to prevention and control of oil and fuel spills. Any spill associated with the Proposed Action would be an isolated event with rapid dissipation and low risk of exposure to marine mammals. The recovery of lost equipment could affect marine mammals through the potential impact from entanglement stemming from the dragging of grapnel lines. The extent of impacts from the grapnel lines would be dependent upon the type of lost equipment, which would dictate the number of attempts made at recovery. Regardless, the potential for marine mammals to interact with the grapnel line and to become entangled is extremely unlikely given the low probability of a marine mammal encountering the line within the Gulf of Maine. Impacts from additional vessel traffic and noise associated with recovery of lost equipment likely would be from a single vessel and are therefore not expected to disrupt the normal or routine functions of marine mammals.

3.3.5.2 Conclusion

Overall, impacts from site characterization and site assessment activities on marine mammals in the GAA are expected to be **minor** because potential impacts on individuals from the scale and nature of activities proposed, while detectable and measurable, would not threaten viability of marine mammal species. When accounting for the likelihood of effects, impacts on marine mammals would range from **negligible** to **minor** depending on the activity being conducted and the species affected. It is expected that most impacts on the affected resource would be avoided with proper mitigation. If a vessel strike or entanglement were to occur, effects on mysticete (other than the NARW), odontocete, and pinniped individuals would be detectible and measurable, but the viability of the species would not be threatened whereas severe population-level effects that compromise the viability of the NARW would be possible. However, the likelihood of a vessel strike or entanglement as a result of the Proposed Action is considered very low given the expected limited total extent and duration of activities considered. Furthermore, implementation of SOCs and mitigation measures (**Chapter 5**) would minimize potential impacts on marine mammals.

3.3.6 Sea Turtles

Factors that could potentially have an impact on sea turtles from the Proposed Action include acoustic effects from site characterization surveys, vessels, and equipment noise; benthic habitat effects; vessel strike; and entanglement risk due to fisheries monitoring surveys. BOEM has developed SOCs and mitigation measures that would apply to site assessment and site characterization activities, as applicable (**Chapter 5**). These include measures designed to prevent or reduce possible impacts on sea turtles during activities associated with the Proposed Action and are hereby incorporated by reference for the analysis below.

Detailed discussions on underwater sound and its importance to sea turtles and their hearing capabilities can be found in the NMFS BA (BOEM, 2023b). As discussed in **Section 3.3.5**, the only site assessment and characterization surveys that produce noise that could affect sea turtles would be vessel activities, geotechnical surveys, and HRG surveys (**Table 2-1**). Also as described for marine mammals, no PTS is expected for any sea turtles given the nature of these sources (BOEM, 2023b). Therefore, this effect is not discussed further in this section. The behavioral disturbance threshold for sea turtles is an SPL of 175 dB re 1 µPa recommended by Finneran et al. (2017), which applies to all sound source types.

The most likely effects of vessel noise on sea turtles are behavioral disturbances. Vessel noise has the potential to result in infrequent behavioral impacts on sea turtles, including temporary startle responses and changes to submergence patterns, masking of biologically relevant sounds, and physiological stress (National Science Foundation and U.S. Geological Survey, 2011; Samuel et al., 2005). Sea turtles may respond to vessel approach, noise, or both, with a startle response (diving or swimming away) and/or a temporary stress response by increasing submergence time between breaths, increasing duration of dives, or swimming to the surface (Lenhardt, 1994; National Science Foundation and U.S. Geological Survey, 2011; O'Hara and Wilcox, 1990; Samuel, 2004). A recent study suggests that sea turtles may exhibit temporary threshold shift effects even before they show any behavioral response (Woods Hole Oceanographic Institution, 2022). Hazel et al. (2007) demonstrated that sea turtles appear to respond behaviorally to vessels at approximately 33 feet (10 meters) or closer. Based on the source descriptions provided in **Section 3.3.5**, the behavioral threshold for sea turtles is likely to be exceeded by project vessels. Popper et al. (2014) suggest that in response to continuous shipping sounds, sea turtles have a high risk for behavioral disturbance closer to the source (e.g., tens of meters), moderate risk at hundreds of meters from the source, and low risk at thousands of meters from the source.

Behavioral effects are considered possible but would be temporary, with effects dissipating once the vessel or individual has left the area. Given the low volume of vessel traffic under the Proposed Action and relatively short duration (**Section 2.2**) and the vessel speed reductions included in the SOCs and mitigation measures (**Chapter 5**), which would help reduce the level of noise produced by project vessels (ZoBell et al., 2021), prolonged behavioral disturbances to foraging, migrating, or mating behavior are unlikely to occur. Overall, the behavioral disturbances that could result from exposure to vessel noise would not disrupt the normal routine function of sea turtles in the Gulf of Maine and impacts would therefore be minor**.**

Geotechnical surveys using drilling or coring equipment would also be detectable by sea turtles but, based on the back-calculated source level, expressed as SPL, of 187 dB re 1 µPa at 1 meter (Chorney et al., 2011), the behavioral disturbance threshold for sea turtles would only be exceeded within approximately 16 feet (5 meters) of the source using spherical spreading loss equations. Therefore, while geotechnical survey noise may be detectable it is unlikely to result in measurable behavioral effects for any sea turtle species and potential impacts are therefore negligible.

The range to the behavioral threshold resulting from HRG survey equipment operations is smaller because the behavioral disturbance threshold for sea turtles is higher than that for marine mammals (**Section 3.3.5**). Only a subset of geophysical sources (e.g., boomers, sparkers) are likely to be audible by sea turtles given the frequency range of the sounds and the hearing range of turtles (see hearing discussion in **Section 3.3.4**), but that subset may cause short-term behavioral disturbance, avoidance, or stress (National Science Foundation and U.S. Geological Survey, 2011). Many HRG sources operate at frequencies above the sea turtle hearing range and thus are not expected to affect them. Recently, BOEM and the U.S. Geological Survey characterized the acoustic qualities of HRG sources and their potential to affect marine animals, including sea turtles (Ruppel et al., 2022). In addition to frequency range, other characteristics of the sources like the source level, duty cycle, and beamwidth make it very unlikely that these sources would result in behavioral disturbance of sea turtles, even without mitigation (Ruppel et al., 2022). Given the intensity of noise generated by this equipment (Crocker and Fratantonio, 2016) and the short duration of proposed surveys, HRG activities are unlikely to result in PTS for any turtle species. Sea turtles would have the potential to be exposed to sound levels that meet or exceed behavioral disturbance thresholds from these sources; however, any effects of exposure to noise above thresholds are transient and would dissipate as the vessel moves away from the turtle. With the relatively short duration of the HRG surveys (**Section 2.2**), the small distances to the behavioral disturbance thresholds, and the mitigation included in the Proposed Action (**Chapter 5**), impacts would not disrupt the normal or routine functions of sea turtles and would therefore be minor.

Potential impacts on sea turtles include strikes from vessels used during site assessment and site characterization activities. Effects from vessel strikes range from minor injuries to mortality, depending on the species and severity of the strike. BOEM estimates that the total number of vessel trips from routine activities under the Proposed Action would be approximately 1,042 vessel roundtrips over an approximately 6-year period. While vessel traffic anticipated as a result of the Proposed Action would add to the existing vessel traffic in the region, the estimated number of roundtrips over a 6-year span would be a relatively small amount of activity (**Section 3.3.8**). BOEM's required implementation of the SOCs and mitigation measures for site assessment and site characterization activities (**Chapter 5**) includes measures designed to minimize potential vessel strikes. However, the relatively small size of turtles and the significant time spent below the surface makes their observation by vessel operators extremely difficult, thereby reducing the effectiveness of observers to mitigate vessel strike risk on sea turtles. Nevertheless, the use of trained lookouts would serve to reduce potential collisions. In addition to the low risk of strikes, typical site assessment and site characterization surveys are generally conducted at slow operational speeds (typically 4 to 6 knots), further reducing the risk of a strike by allowing observers to spot a sea turtle within the vessel strike zone and take evasive maneuvers, if needed, to avoid a strike. Transits, however, may be conducted at higher speeds (10 knots or greater).

The contribution of vessel traffic under the Proposed Action would represent only a small portion of the overall annual increases in vessel traffic in the region. Potential impacts on sea turtles from vessel strikes during site assessment and site characterization activities are therefore expected to be minor because of the low probability of such an event, the application of SOCs and mitigation measures, and the relatively low level of vessel traffic expected under the Proposed Action.

Proposed Action-related fisheries monitoring surveys would be of limited frequency and duration (**Table 2-1**). The contribution of fisheries sampling gear under the Proposed Action would represent a very small portion of the overall and ongoing fishing activity in the Gulf of Maine (**Section 3.3.9**). The potential for sea turtles to interact with and become entangled in monitoring survey fishing gear is therefore low. Green, loggerhead, and Kemp's ridley sea turtles may be captured during trawl surveys and capture would cause stress and may result in injury and, in rare cases, post-capture mortality. While leatherback sea turtles are less likely to be captured during trawl surveys, they are at a heightened risk of entanglement in trap and pot gear. All sea turtle species are at risk of entanglement with gillnet fishing gear. However, given the limited extent and duration of monitoring surveys, the low overall sea turtle density and habitat use in the Gulf of Maine, and the implementation SOCs and mitigation measures, the overall impacts on sea turtles from gear utilization under the Proposed Action are anticipated to be minor. BOEM recognizes that some fishery surveys could affect ESA-listed species and is preparing a Section 7 ESA consultation to address these impacts to minimize or eliminate, as best possible, impacts on ESA-listed species.

Potential impacts on sea turtles during FLiDAR buoy installation, operation, and decommissioning include associated vessel traffic (considered above for vessel strike risk), possible entanglement in the mooring, and temporary disturbance of benthic habitat. The installation and presence of a FLiDAR buoy and its associated mooring would result in a temporary disturbance and a loss of benthic habitat over a very small area within the GAA. A single FLiDAR buoy within the Gulf of Maine is unlikely to alter distribution of any forage species for sea turtles. The anchor chain sweep for the buoy mooring is expected to denude a small area around the anchor, but the area of benthic habitat loss would be very small compared to the available habitat in the Gulf of Maine and is not expected to have any measurable or detectable negative impact on foraging abilities of sea turtles. Additionally, high tension of the buoy chain for the FLiDAR buoy would reduce risk of entanglement (Anderson, 2021; BOEM and USACE, 2013). Potential impacts on sea turtles from FLiDAR buoy installation and operation are expected to be negligible. During FLiDAR buoy removal, disturbance of the sediment can cause elevated levels of turbidity, which may negatively affect prey items in a localized area. However, impacts would be of lower magnitude than those resulting from installation activities and are expected to be negligible. Potential impacts on sea turtles due to loss of habitat, changes to prey abundance, and distribution from installation of the FLiDAR buoy is expected to be non-measurable and negligible.

3.3.6.1 Non-Routine Events

Non-routine events (**Section 2.2.2**) that could affect sea turtles include spills and recovery of lost equipment. Similar to marine mammals, sea turtles are susceptible to the effects of contaminants from pollution and spills, which can lead to issues in reproduction and survivorship and other health concerns (e.g., Hall et al., 2018; Jepson et al., 2016; Murphy et al., 2018; Pierce et al., 2008). All vessels would be expected to comply with USCG requirements relating to prevention and control of oil and fuel spills. Any spill associated with the Proposed Action would be an isolated event with rapid dissipation and low risk of exposure to sea turtles. The recovery of lost equipment could affect sea turtles through entanglement risk related to the dragging of grapnel lines. The extent of impacts from the grapnel lines would be dependent upon the type of lost equipment, which would dictate the number of attempts made at recovery. Regardless, the potential for sea turtles to interact with the grapnel line and become entangled is extremely low given the low probability of a sea turtle encountering the line within the Gulf of Maine. Impacts from additional vessel traffic and noise associated with recovery of lost equipment likely would be from a single vessel with possible but temporary behavioral effects on a limited number of individual sea turtles.

3.3.6.2 Conclusion

Overall, impacts on sea turtles from noise, benthic habitat effects, vessel strike, and entanglement risk are expected to be **minor** because of the temporary and infrequent noise generated and generally low probably of vessel strikes and entanglement with the scale of the proposed activities. When accounting for the likelihood of effects, potential impacts on sea turtles would range from **negligible** to **minor** depending on the activity being conducted. Effects would be notable, but the resource would be expected to recover completely with proper mitigation. Implementation of SOCs and mitigation measures (**Chapter 5**) would minimize the potential for adverse impacts on sea turtles.

3.3.7 Military Use

Vessels associated with the Proposed Action could interact with military aircraft and vessels during site characterization and site assessment survey or monitoring activities. As described in **Section 3.3.8**, the Proposed Action would add to existing vessel traffic within the region. Additional traffic in this area could result in space-use conflicts with existing military activities because the Research Lease Area overlaps with the Boston Range Complex and Airspace Warning Area W-103 where military activity takes place. The increase in vessel traffic could also lead to an increase in port congestion, which would affect military use of those ports. Additionally, vessels associated with the Proposed Action traveling to and from ports could overlap with the U.S. Navy sea trials of new Arleigh Burke-class destroyers that take place in port and in waters nearshore in the vicinity of Bath, Maine. Although less predictable, Proposed Action vessels may also encounter activities associated with USCG search and rescue and Marine Environmental Protection missions.

The only offshore structure associated with the Proposed Action is a temporary FLiDAR buoy. Due to the limited number and the temporary nature of these structures, no conflicts with existing and planned military uses are anticipated, as they would not significantly change navigational patterns or add to the navigational complexity of the region.

To avoid or minimize potential conflicts with existing DOD activities, site-specific stipulations may be necessary. Such stipulations would be identified during BOEM's future coordination with DOD if a lease is issued in these areas and a Construction and Operations Plan is submitted for approval.

3.3.7.1 Non-Routine Events

Non-routine events that could potentially have impacts on military use include the recovery of lost survey equipment through temporary space-use conflicts. The extent of impacts would depend on the type of lost equipment. The size of the lost equipment and/or the replacement cost would dictate the number of attempts made at recovery. The number of recovery attempts could affect the size of the resultant impact area and time spent searching. The potential for recovery operations to interact with military use activities is low given that recovery operations would typically involve one vessel for a short period of time.

3.3.7.2 Conclusion

Overall, BOEM anticipates that the impacts on military use as a result of site characterization and site assessment activities for the Proposed Action would be **negligible** because vessel activity associated with the Proposed Action and the placement of a temporary FLiDAR buoy are not expected to lead to significant space-use conflicts with existing military activities in the region. The overall effect would be small, and the resource would be expected to return to a condition with no measurable effects without mitigation.

3.3.8 Navigation and Vessel Traffic

The routine activities associated with the Proposed Action that would affect navigation and vessel traffic are vessel traffic for site characterization surveys and installation, maintenance, and decommissioning of a FLiDAR buoy. BOEM estimates 1,042 vessel roundtrips would be needed to conduct routine activities over an approximately 6-year period (**Appendix A**). Vessel traffic anticipated as a result of the Proposed Action would add to the existing vessel traffic in the area (**Figure 3-5**). The approximately 174 vessel roundtrips per year resulting from the Proposed Action represent 0.0004 percent of the average annual vessel tracks counted in the Gulf of Maine from 2019 to 2021 (**Table 3-8**) and 80 percent of the average vessels tracks counted in the requested lease area (**Table 3-9**) during the same time period. Similarly, the approximately 174 vessel roundtrips per year resulting from the Proposed Action represent 0.4 percent of total commercial vessel counts for the four major ports in the Gulf of Maine from 2017 to 2020 (**Table 3-7**).

The additional vessel traffic associated with the Proposed Action would increase the potential for interference with other marine uses in the area. However, the estimated number of roundtrips over the approximately 6-year span of the Proposed Action would be a relatively small amount of activity, and impacts can be minimized by adherence to standard marine navigation rules and through proper scheduling and notification to the marine community.

Vessel traffic in the Research Lease Area is light and follows distinct patterns to and from the regional ports. The Research Lease Area is not within existing designated routing measures, but the western edge is approximately 2.5 nm (4.6 km) east of the Eastern Approach TSS entering and exiting the port of Portland, Maine. USCG's Marine Planning Guidelines recommend a 5-nm (9.3-km) buffer zone of a TSS entry and exit area (as depicted on **Figure 2-1**) as the minimum distance necessary to enable vessels to detect one another visually and by radar where vessels are converging and diverging from multiple locations and for a large vessel to maneuver in an emergency. Approximately 9,856 acres (40 km^2) or 14 percent of the Research Lease Area are within the buffer zones of the Eastern Approach TSS.

The USCG's Final Port Access Route Study on the Approaches to Maine, New Hampshire, and Massachusetts recommends establishing six new fairways designed to facilitate the needs of various types of vessel traffic throughout the port access route study area (USCG, 2023). Most notably, the study recommends a Portland Eastern Approach Fairway to meet the needs of vessel traffic entering and exiting the Portland Eastern Approach TSS. The study justified the recommended Portland Eastern Approach Fairway to ensure sufficient maneuvering space for vessels to manage complex meeting situations and cross traffic departing or converging on the existing Portland Eastern Approach TSS. Approximately 37,474 acres (152 km^2) or 55 percent of the Research Lease Area directly overlaps this recommended fairway.

Within portions of the Research Lease Area that overlap the TSS buffer and recommended fairway, there is the potential for space-use conflicts with the current vessel traffic and Proposed Action activities, such as the installation of a FLiDAR buoy and slow-moving survey vessels with limited maneuverability. However, a review of AIS vessel transit count data from years 2019 through 2022 (as presented in USCG, 2023 and depicted on **Figure 3-5** for year 2022) suggests the highest densities of vessel traffic do not pass through the Research Lease Area and, therefore, are not anticipated to result in unavoidable space-use conflicts. Additionally, the State of Maine will submit an application to USCG for Private Aids to Navigation and comply with all lighting and marking requirements, as well as request a Local Notice to Mariners prior to the installation of the FLiDAR buoy. In consideration of the relatively low volume of existing vessel traffic and lighting and notification requirements, the installed FLiDAR buoy and survey vessel traffic are not likely to pose obstructions to navigation, although a remote potential for space-use conflicts exists in complex navigational scenarios. Should the research lease be issued within the Portland Eastern Approach Fairway, potential future installation of permanent or temporary offshore wind energy structures would be also prohibited if the fairway is codified through future rulemaking.

3.3.8.1 Non-Routine Events

Non-routine events that could potentially have impacts on navigation and vessel traffic include the recovery of lost survey equipment, allisions and collisions, and oil spills through temporary space-use conflicts. The extent of impacts from lost survey equipment would depend on the type of lost equipment. The size of the lost equipment and/or the replacement cost would dictate the type of equipment deployed and the number of attempts made at recovery. The number of recovery attempts could affect the size of the resultant impact area and time spent searching. Additionally, the location of the lost equipment could affect the impact on other resources. Regardless, the potential for recovery operations to interact with vessel traffic is low, given that recovery operations would likely involve one vessel for a short period of time; therefore, impacts are not expected to disrupt the activity of other vessels. As described in **Section 2.2.2.2**, the potential for allisions and collisions would be minimized through adherence to USCG Navigation Rules and Regulations; therefore, risk of damage to vessels and equipment and other conflicts are considered unlikely. The potential for and size of an oil spill, should one occur, would be minimized through application of requirements described in **Section 2.2.2.3** and impacts on vessel traffic would be limited to a localized area for a short duration.

3.3.8.2 Conclusion

Overall, BOEM anticipates that impacts on navigation and vessel traffic from site characterization and site assessment activities are expected to be **negligible** to **minor** depending on the location selected for installation of the FLiDAR buoy and USGC's final rulemaking for the recommended Portland Eastern Approach Fairway. Vessel activity over the approximately 6-year span of activities associated with the Proposed Action is expected to be relatively small compared to existing vessel traffic at the ports and between the shore and the Research Lease Area. Although vessel traffic within the Research Lease Area could more than double from the 2019 to 2021 average of 137 unique vessels, space-use conflicts are still anticipated to be uncommon at these relatively low traffic volumes. However, if installation of the FLiDAR buoy and survey vessel traffic occurs within the recommended Portland Eastern Approach Fairway, **minor** impacts could result from space-use conflicts with shipping vessel traffic. These space-use conflicts are anticipated to be uncommon based on the relatively low volume of existing vessel traffic and lighting and notification requirements but could occur in complex navigational scenarios. Should the research lease and associated site assessment and site characterization activities be located outside of the recommended Portland Eastern Approach TSS and Fairway, impacts are expected to be **negligible** because areas outside of the fairway are less likely to be used for maneuvering of shipping vessels. In either scenario, the overall effect would be small, and the resource would be expected to return to a condition with no measurable effects without any mitigation.

3.3.9 Commercial and Recreational Fishing

The Proposed Action would result in increased vessel traffic in the area and the temporary exclusion/displacement of vessels to prevent conflicts and collisions with survey vessels and gear. Exclusion/displacement is a result of survey activities involving geotechnical exploration, and other operations are expected to be on the scale of hours and confined to the immediate area around the survey ship. Vessels not related to site characterization or site assessment activities that may be transiting the area could use USCG notices (i.e., Local Notice to Mariners) to avoid the areas where the site assessment or site characterization activities are occurring. Regardless, impacts on commercial and recreational fishing activities from surveys for site characterization could vary depending on the fishing gear type used (e.g., anglers using fixed gear such as lobster pots could need to retrieve their gear before a survey vessel in their fishing location could potentially transit over their gear).

Site characterization and site assessment activities are expected to take place in the spring and summer months, which would overlap with commercial and recreational fishing seasons. Commercial and recreational fishing would not be broadly excluded from the Research Lease Area and associated survey areas; temporary exclusion would only be necessary within the immediate footprint of site characterization and site assessment activities. However, noise generated from low-frequency sound (produced by some survey equipment) may result in decreased catch rates of fish while some surveys are occurring. Decreased catch rates may be most notable in hook and line fisheries because behavioral changes may reduce the availability of the fish to be captured in the fishery (Lokkeborg et al., 2012; Pearson et al., 1992). The direct impact of these noise sources on fish is expected to range from negligible to minor.

The FLiDAR buoy gravity anchor could provide previously unavailable habitat for species that prefer structured and hard-bottom habitats, creating a temporary increase in these types of fish near the buoy while the structure is in place. Additionally, the buoy itself may provide habitat for pelagic species such as dorado (also known as dolphinfish). Installation of a FLiDAR buoy could, therefore, have a temporary beneficial effect on commercial and recreational fisheries, depending on the species of interest and the fishing gear used.

Impacts from seafloor disturbances are anticipated to range from negligible to minor for commercial and recreational fisheries. Mollusks, such as sea scallops, would likely be adversely affected (buried or crushed) in the immediate area of the buoy gravity anchor and suffer from increases in suspended sediment load during the installation and removal (i.e., decommissioning) process; however, the area affected by the FLiDAR buoy installation would be small relative to the area available for commercial and recreational fishing.

Most coastal recreational fishing for Maine, New Hampshire, and Massachusetts takes place away from the Research Lease Area. Also considering the increase in vessel traffic associated with the Proposed Action, impacts of increased vessel traffic on commercial and recreational fishing are anticipated to be negligible. As described in **Section 3.3.8**, the approximately 174 vessel roundtrips per year resulting from the Proposed Action represent 0.0004 percent of the average annual vessel tracks counted in the Gulf of Maine from 2019 to 2021 (**Table 3-8**) and 80 percent of the average vessels tracks counted in the requested lease area (**Table 3-9**) during the same time period. Although commercial fishing vessels may transit the Research Lease Area on route to historical fishing grounds, site assessment and site characterization activities or FLiDAR buoy installation activities likely would not interfere with access to active fishing grounds outside of the need to change transit routes slightly to avoid survey and installation vessels and the installed FLiDAR buoy. After the FLiDAR buoy is decommissioned and removed, the proposed sites would pose no obstacle to commercial or recreational fishing.

There are numerous port and marina locations shoreward of the Research Lease Area that may be used by commercial fishing vessels, recreational vessels, and project vessels. The estimated 1,042 vessel roundtrips needed to conduct routine activities for the Proposed Action over an approximately 6-year period, which may originate out of various ports identified in **Table 2-1**, would be small relative to existing use and are not expected to adversely affect current use of these facilities. As described in **Section 3.3.8**, the approximately 174 vessel roundtrips per year resulting from the Proposed Action represent 0.4 percent of total commercial vessel counts for the four major ports in the Gulf of Maine from 2017 to 2020 (**Table 3-7**).

3.3.9.1 Non-Routine Events

Non-routine events that could potentially have impacts on commercial and recreational fishing include recovery of lost survey equipment through the temporary displacement of fishing activities. The extent of impacts would depend on the type of lost equipment; the larger the equipment lost, or the more costly it would be to replace, the more attempts would be made at recovery. The number of recovery attempts could affect the size of the resultant impact area and time spent searching. The location where the equipment is lost would also dictate the impact on other resources.

Furthermore, unrecovered lost survey equipment could interfere with commercial and recreational fishing activities by acting as a potential hazard for bottom-tending fishing gear. For example, a broken vibracore rod that cannot be retrieved may need to be cut and capped 1 to 2 meters below the seafloor to remove the potential hazard, which would result in bottom disturbance to the immediate vicinity of the lost equipment. Most fishing gear penetrates less than 1 meter, but 2-meter burial may be required and would be determined on case-by-case basis with BOEM and BSEE. In any case, the potential for recovery operations to interact with commercial or recreational fishing activities is low given that recovery operations would likely involve one vessel for a short period of time.

3.3.9.2 Conclusion

Overall, impacts on commercial and recreational fishing under the Proposed Action are expected to be **minor** based on multiple factors, including the low level of vessel traffic activity associated with site characterization and site assessment activities relative to existing traffic, the fact that a single FLiDAR buoy would be installed over a relatively large geographic area, and the relatively small spatial area and limited duration of sound produced from routine activities and events. Impacts are expected to range from **negligible** to **minor** depending on the fishery and Proposed Action activity, as effects would be notable but the resource would be expected to recover completely without remedial or mitigating action. Communication and coordination between a lessee and affected anglers could greatly reduce the potential for conflict during vessel movement and meteorological buoy installation activities.

3.3.10 Recreation and Tourism

A 2012 BOEM study identified that the Maine and Massachusetts counties within the GAA are susceptible to impacts on their recreation and tourism economies and employment as a result of offshore wind development (BOEM, 2012a). Potential recreational impacts of the Proposed Action could include the risk of recreational vessel allision with in-water structures, increased navigational complexity, vessel traffic congestion, and space-use conflicts.

Vessels associated with the Proposed Action could interact with recreational vessels during site characterization and site assessment survey or monitoring activities. The majority of boating activity occurs within approximately 20 miles (32 km) of the coast; as such, impacts would be limited to recreational activities that extend farther offshore, such as whale-watching expeditions and sailing regattas (Northeast Regional Planning Body, 2016). While many popular whale-watching sites and regattas are located in the Gulf of Maine, none directly overlap with the Research Lease Area (Northeast Regional Ocean Council, 2009). Potential space-use conflicts between recreational vessels and vessels associated with the Proposed Action would be limited to survey vessels coming from and going to ports. Although the Proposed Action would add to existing vessel traffic in the region, the vessel activity associated with the Proposed Action is expected to be relatively small compared to existing vessel traffic at the ports, in the Research Lease Area, and between the shore and the Research Lease Area.

Offshore structures associated with the Proposed Action would be limited to the placement of a temporary FLiDAR buoy. Offshore routes for recreational boaters, sailing regattas, and sightseeing boats may need to be altered to avoid allision risks with the in-water structure. However, no substantial or long-term conflicts with existing and planned recreation and tourism uses are anticipated with the single, temporary buoy. The temporary FLiDAR buoy is not expected to significantly change navigation patterns or add to the navigational complexity of the Research Lease Area.

3.3.10.1 Non-Routine Events

Non-routine events that could potentially have impacts on recreation and tourism include the recovery of lost survey equipment through temporary space-use conflicts. The extent of impacts would depend on the type of lost equipment. The size of the lost equipment and/or the replacement cost would dictate the number of attempts made at recovery. The number of recovery attempts could affect the size of the resultant impact area and time spent searching. The potential for recovery operations to interact with recreation and tourism activities is unlikely given that recovery operations would typically involve one vessel for a short period of time.

3.3.10.2 Conclusion

Overall, BOEM anticipates that the impacts on recreation and tourism as a result of site characterization and site assessment activities for the Proposed Action would be **negligible** because transient vessel activity associated with the Proposed Action and the 24-month deployment of a temporary FLiDAR buoy are not expected to lead to significant space-use conflicts with existing recreational activities in the region. The overall effect would be small, and the resource would be expected to return to a condition with no measurable effects without mitigation.

3.3.11 Cultural, Historical, and Archaeological Resources

Geophysical surveys and most biological surveys and monitoring would not create bottom disturbance, and therefore no impacts would be expected on submerged cultural resources during routine surveys of these types. Subsurface geotechnical investigations, benthic sampling, bottom and lobster trawl surveys, installation of the FLiDAR buoy, and vessel anchoring would result in small, localized disturbances of the seabed. BOEM's Guidelines for Providing Archaeological and Historic Property Information Pursuant to 30 CFR Part 585 state that a qualified marine archaeologist should design and interpret the results of geophysical surveys before bottom disturbance occurs (BOEM, 2020). Consequently, submerged cultural resources would be avoided during site assessment and site characterization activities. Accordingly, previous NEPA documentation developed for, or assessing, site characterization and site assessment campaigns has determined that the potential to affect historic properties is expected to be negligible (BOEM, 2013, 2014a, 2016, 2021b).

Temporary placement of a FLiDAR buoy and vessels conducting site characterization surveys have the potential to affect the viewshed of onshore historic properties with open views in the direction of the Research Lease Area. The FLiDAR buoy and vessel traffic associated with surveys may fall within the viewshed of these onshore properties. The presence of the FLiDAR buoy is expected to result in negligible impacts on onshore historic properties because its visibility from onshore locations would be temporary (lasting approximately 2 years) and indistinguishable from lighted vessel traffic if visible from distances at least 19 nm (35 km) away. Potential increased vessel traffic associated with site characterization surveys also would be temporary in nature. These vessels would be indistinguishable from existing vessel traffic and only result in a nominal increase in existing vessel traffic over the approximately 6-year span of activities. The vessel traffic would be both temporary and indistinguishable from existing vessel traffic in the GAA; therefore, it is expected to be noticed from onshore historic properties.

3.3.11.1 Non-Routine Events

The retrieval of lost equipment could result in seafloor disturbance that could affect potential historic properties. Lost equipment may be located and/or retrieved through dragging anchors or some other form of grapnel tool across the seafloor. Such activities have the potential to affect submerged cultural resources by disturbing the bottom during search and retrieval. Potential impacts could be lessened or avoided if potential historic properties that have already been identified are avoided during retrieval, or, if geophysical data exist for the area, it could be reviewed to identify potential resources. Regardless, the potential for recovery operations to interact with submerged cultural resources is extremely unlikely given the expanse of the Research Lease Area and other potential locations of site characterization activities and the limited area affected by recovery operations.

3.3.11.2 Conclusion

Overall, impacts on cultural, historical, and archaeological resources from the Proposed Action are expected to be **negligible** due to the relatively small and localized areas of disturbance and with implementation of SOCs to identify and avoid submerged historic properties. Impacts on submerged historic properties from site characterization activities are expected to be **negligible** given the geophysical surveying and interpretation requirements discussed above. Impacts on submerged historic properties from installation of the FLiDAR buoy are expected to be **negligible**, as avoidance would be required by BOEM. If avoidance of potential historic properties is not feasible, BOEM would continue its Section 106 consultation as described in **Section 6.2.4** to resolve adverse effects. Vessel traffic associated with the Proposed Action would be temporary and indistinguishable from existing vessel traffic. Therefore, impacts on onshore historic properties from site characterization activities are expected to be **negligible**.

4 Cumulative Impacts

This section considers the cumulative impacts of the No Action Alternative and Proposed Action on resources discussed in **Chapter 3** when combined with impacts of other ongoing and reasonably foreseeable planned activities.

Appendix C provides a description of ongoing and planned activities with IPFs that overlap both spatially and temporally with IPFs from the Proposed Action. These ongoing and planned activities could contribute to cumulative impacts on the same resources. **Appendix C** also discusses the effects of climate change, which would contribute to a variety of ongoing and interconnected changes to future baseline conditions of the affected environment.

The No Action Alternative would have no impacts on the baseline condition of the affected environment and, therefore, would not result in incremental effects that contribute cumulatively to impacts from other ongoing and planned activities.

The cumulative impacts of the Proposed Action are described in the following sections.

4.1 Ecosystem-Based Management and Trade-Offs

Per Spooner et al. (2021), both domestic and international regulators and natural resource managers are implementing EBM (e.g., see Garcia et al., 2003; NMFS, 2016; Pedreschi et al., 2019) to address ecosystem-level changes, address project-specific impacts, and protect ecosystem function. EBM, within an adaptive management framework that allows revisitation and potential revision, utilizes the expertise and working knowledge of natural and social scientists, interested parties, and resource managers to broaden their assessment of current ecosystem condition and identify key drivers affecting ecosystem function. This approach is being considered within the context of cumulative impacts, the latter of which considers all similar activities within the spatial and temporal boundaries of the Proposed Action.

A well-founded EBM approach depends on the availability of reliable and accurate ecological, social, and economic information, and the identification and consideration of key data deficiencies. The advantages of an EBM approach are based, in part, on the shortcomings evident in standard environmental impact assessment methodologies, which include a focus on individual species or major taxonomic groups. An EBM approach provides a more holistic characterization of the ecosystem and allows for further insight into how a particular ecosystem functions. Under this approach, regulators have the ability to weigh the ecosystem costs and benefits of specific projects. EBM is an integrated approach to management that considers the entire ecosystem, including the biological, physical, chemical, and social aspects of the affected environment. It requires consideration of all elements that are integral to ecosystem function, accounting for economic, social, and environmental costs and benefits (e.g., see McLeod et al., 2005). The ultimate goal of an EBM approach to impact assessment and identification of viable mitigation measures is to maintain an ecosystem in a productive and resilient condition, one that supports proper ecosystem function and allows for long-term support of potentially a broad suite of ecosystem services.

A resilient and productive ecosystem is the foundation for sustainable development, continuing productivity and ecosystem function, and the conservation of biodiversity. Functioning marine ecosystems support the provisioning of food, energy, and natural products while simultaneously providing cultural and aesthetic value and providing opportunities for tourism and recreation, among other activities. Additionally, marine ecosystems play important roles in nutrient cycling, climate regulation, and storm protection. Marine ecosystems also support human livelihoods for coastal communities, with a variety of economic sectors depending on a fully functioning ecosystem.

In the current context, the implementation of EBM requires a framework to assess the status of the Gulf of Maine ecosystems in relation to specific regulator-based management goals and objectives and to evaluate the potential outcomes of alternative management strategies. Per McLeod et al. (2005), an optimal EBM approach should (1) emphasize the protection of ecosystem structure, functioning, and key processes; (2) be location specific, focusing on a specific ecosystem and the range of activities affecting it; (3) explicitly account for the internal linkages within the ecosystem (e.g., identifying the important interactions between target species or key services and other non-target species); (4) recognize that society relies upon and benefits from the ecosystem through ecosystem services; (5) acknowledge the internal linkages among systems; and (6) integrate ecological, social, economic, and institutional perspectives, recognizing their strong interdependences.

4.2 Cumulative Impact Conclusions for the Proposed Action

Table 4-1 characterizes the total cumulative impacts on each affected resource resulting from incremental effects of (1) ongoing and planned activities and (2) impacts of the Proposed Action. The incremental contribution of the Proposed Action to cumulative impacts for individual resources would range from negligible to minor and be limited in duration to the timeframe necessary to conduct site assessment and site characterization activities. Considered together, the Proposed Action’s contribution to cumulative impacts would not result in significant impacts on marine ecosystem condition or function (due to biological, physical, or chemical changes), the livelihood of coastal communities that rely on marine resources (due to impacts on commercial fisheries), or other social uses (such as marine mineral or military use). Climate change could contribute to cumulative impacts when combined with the incremental impacts of the Proposed Action by altering baseline environmental conditions and putting stress on natural ecosystems. Climate change results primarily from the increasing concentration of GHG emissions in the atmosphere, which causes planet-wide physical, chemical, and biological changes, substantially affecting the world’s oceans and lands. The State of Maine’s goal for obtaining the offshore wind research lease is to combat climate change and promote renewable energy to reduce GHG emissions and take advantage of the significant economic opportunity offered by clean energy and innovation (State of Maine, 2021). These long-term social and economic aspirations are weighed against the short-term, negligible to minor impacts of BOEM issuing the research lease and the resultant site assessment and site characterization activities.

Table 4-1. Cumulative impact conclusions

Resource	Incremental Impacts of Ongoing and Planned Activities	Incremental Impacts of Proposed Action	Total Cumulative Impacts
Air Quality and Greenhouse Gas Emissions	**Minor** impacts on air quality due to vessel traffic as well as pollutants emitted from onshore sources and transported by winds in the GAA.	**Negligible** impacts on air quality from vessel operations.	The Proposed Action in combination with ongoing and reasonably foreseeable planned actions would result in **minor** impacts on air quality.
Water Quality	**Minor** impacts on water quality during the study period due to continuation of climate change-influenced increases in ocean temperatures, acidification, and salinity resulting in shifts in the distribution of and suboptimal conditions for marine organisms.	**Negligible** impacts on water quality from routine vessel discharges and seafloor disturbances that would temporarily increase local turbidity and water clarity.	The Proposed Action in combination with ongoing and reasonably foreseeable planned actions would result in **minor** impacts on water quality predominated by the effects of climate change.
Benthic Resources	**Minor** impacts on benthic resources from ongoing activities and conditions, especially climate change, commercial fishing using bottom-tending gear (e.g., dredges, bottom trawls, traps/pots), and sediment dredging for navigation.	**Negligible** impacts on benthic resources due to small, localized areas subject to crushing from direct contact with the gear, smothering by elevated sedimentation levels, and resuspension.	The Proposed Action in combination with ongoing and reasonably foreseeable planned actions would result in **minor** impacts on benthic resources.
Finfish, Invertebrates, and Essential Fish Habitat	**Minor** impacts on finfish, invertebrates, and EFH from ongoing activities and conditions, especially harvest, bycatch, dredging, bottom trawling, and climate change.	**Negligible** impacts on finfish, invertebrates, and EFH from survey activities associated with the Proposed Action. Once the survey activities are complete, the EFH and the managed species that utilize the habitats within the GAA are expected to return to pre-survey conditions.	The Proposed Action in combination with ongoing and reasonably foreseeable planned actions would result in **negligible** impacts on finfish, Invertebrates, EFH, or ESA-listed species and no population-level impacts were identified. The survey activities would not increase or synergistically compound any environmental impacts originally occurring within the defined GAA.

Resource	Incremental Impacts of Ongoing and Planned Activities	Incremental Impacts of Proposed Action	Total Cumulative Impacts
Marine Mammals	**Minor** impacts on marine mammals from ongoing and planned activities within the GAA, including vessel strikes and entanglement risk from commercial marine vessels and commercial and recreational fishing activities.	**Negligible** to **minor** impacts on marine mammals depending on the activity being conducted and the species affected. Most impacts on the affected resource would be avoided with implementation of mitigation.	The Proposed Action in combination with ongoing and reasonably foreseeable planned actions would result in **minor** impacts on marine mammals.
Sea Turtles	**Minor** impacts on sea turtles from ongoing and planned activities within the GAA, including vessel strikes and entanglement risk from commercial marine vessels and commercial and recreational fishing activities.	**Negligible** to **minor** impacts on sea turtles depending on the activity being conducted and the species affected. The resource would be expected to recover completely with implementation of mitigation.	The Proposed Action in combination with ongoing and reasonably foreseeable planned actions would result in **minor** impacts on sea turtles.
Military Use	**Negligible** impacts on military use are anticipated as a result of ongoing and planned activities in the region, as routine functions and activities will not be disrupted.	The Research Lease Area overlaps with the Boston Range Complex, creating the potential for space-use conflicts between military vessels and vessels conducting site assessment and site characterization activities as part of the Proposed Action; however, impacts on military use are anticipated to be **negligible**, as routine functions and activities could still continue.	The Proposed Action in combination with ongoing and reasonably foreseeable planned activities would result in **negligible** impacts on military use, as routine functions and activities would not be disrupted.

Resource	Incremental Impacts of Ongoing and Planned Activities	Incremental Impacts of Proposed Action	Total Cumulative Impacts
Navigation and Vessel Traffic	**Negligible** impacts on navigation and vessel traffic use are anticipated as a result of ongoing and planned activities in the region, as routine functions and activities will not be disrupted.	Impacts on navigation and shipping are anticipated to be **negligible** if the research lease is issued outside of the Portland Eastern Approach TSS and recommended Fairway, as routine functions and activities could still continue and impacts can be minimized by adherence to standard marine navigation rules and through proper scheduling and notification to the marine community. Impacts are anticipated to be **minor** if the research lease is issued within the Portland Eastern Approach TSS or recommended Fairway due to the remote potential for space-use conflicts in complex navigational scenarios.	The Proposed Action in combination with ongoing and reasonably foreseeable planned activities would result in **minor** impacts on navigation and shipping use, as routine functions and activities would not be disrupted, but the remote potential for space-use conflicts exists in complex navigational scenarios.
Commercial and Recreational Fishing	**Minor** impacts on commercial and recreational fishing as a result of pressure from ongoing activities, including regulated fishing effort, vessel traffic, other bottom-disturbing activities, and climate change.	**Negligible** to **minor** impacts on commercial and recreational fishing depending on the fishery and Proposed Action activity. The resource would be expected to recover completely without remedial or mitigating action.	The Proposed Action in combination with ongoing and reasonably foreseeable planned actions would result in **minor** impacts on commercial and recreational fishing.
Recreation and Tourism	Ongoing and planned activities are anticipated to have a **negligible** impact on recreation and tourism, as these activities have co-existed in the Gulf of Maine for a substantial amount of time.	Impacts on recreation and tourism as a result of the Proposed Action are anticipated to be **negligible**, as the increased vessel activity and placement of a temporary FLiDAR buoy are not expected to lead to substantial space-use conflicts with existing recreational activities in the region.	The Proposed Action in combination with ongoing and reasonably foreseeable planned activities would result in **negligible** impacts on recreation and tourism routine functions and activities would not be disrupted.

Resource	Incremental Impacts of Ongoing and Planned Activities	Incremental Impacts of Proposed Action	Total Cumulative Impacts
Cultural, Historical, and Archaeological Resources	Minor to major impacts on cultural, historical, and archaeological resources as a result of ongoing and planned activities, including climate change. Implementation of existing federal and state cultural resource laws and regulations would reduce the severity of potential impacts in a majority of cases, resulting in overall **moderate** impacts on cultural resources.	Impacts on submerged historic properties from site characterization activities are expected to be **negligible** with prior identification and avoidance of these resources through geophysical surveying and interpretation. Visual effects of the FLiDAR buoy and vessels used for the Proposed Action would be temporary and indistinguishable from existing vessel traffic and would have **negligible** impacts on onshore historic properties.	The Proposed Action in combination with ongoing and reasonably foreseeable planned activities would result in **moderate** impacts on cultural, historical, and archaeological resources, which in the majority of cases would be reduced in severity through implementation of existing federal and state cultural resource laws and regulations.

5 Standard Operating Conditions and Mitigation

BOEM has identified SOCs and mitigation measures that would apply to site assessment and site characterization activities, as applicable, conducted as a result of the Proposed Action. **Appendix D** lists these conditions and measures, which include general requirements as well as specific requirements related to protected species, archaeological surveys, avian and bat survey and reporting, and fishery monitoring. **Table 5-1** summarizes and incorporates by reference project design criteria and best management practices developed through programmatic consultation with NMFS under Section 7 of the ESA. All SOCs and mitigation measures would be applied as lease stipulations and are intended to avoid, minimize, or mitigate potential impacts on resources and conflicts with other uses of the marine environment.

Table 5-1. Standard operating conditions and mitigation measures incorporated by reference

Reference	Relevance	Applicable Activities
BOEM. 2023b. Gulf of Maine research lease environmental assessment draft biological assessment.	Appendix A of the biological assessment contains PDCs and BMPs to avoid, minimize, and mitigate impacts on ESA-listed species during data collection and site survey activities for renewable energy on the Atlantic OCS.	All vessel use and survey activities that could result in interactions with threatened and endangered species or sensitive habitat areas, or discharge of marine debris.

BMP = best management practice; PDC = project design criterion

6 Consultation and Coordination

This section discusses public involvement and consultations in the preparation of this EA, including a summary of Task Force meetings, public scoping comments, and formal consultations.

6.1 Public Involvement

6.1.1 Intergovernmental Task Force Meetings

Beginning in 2019, BOEM initiated a series of three Task Force meetings, with the most recent occurring in May 2023. The inaugural meeting, which took place on December 12, 2019, aimed to establish a robust framework for coordination and consultation among federal, state, local, and tribal governments. This first meeting also provided updates on recent and upcoming offshore wind activities in New Hampshire, Maine, and Massachusetts. The meeting was attended by a total of 76 Task Force members and 174 members of the public.

During the session, BOEM presented a comprehensive overview of the Offshore Renewable Energy Program, offering detailed information on the phases of the offshore leasing process. State representatives complemented these presentations by delivering insights into recent activities in New Hampshire, Maine, and Massachusetts related to offshore wind. To further advance the discussions and clarify the Task Force's role in the broader planning process, Task Force members actively engaged in smaller group working sessions, focusing on initial steps and responsibilities.

The second meeting, held on May 19, 2022, was focused on gathering feedback on the next steps of the commercial leasing process, including the Request for Interest (RFI) and planned interested party and tribal engagement. BOEM provided details on the commercial leasing process and the narrowing down of potential lease areas through public comment, public engagement, and analysis. Discussion also included the separate process of reviewing Maine's application for a research lease and the need to issue an RFCI. Representatives from each state presented on their priorities, goals, infrastructure, and actions for offshore wind in the Gulf of Maine. Representatives from several federal agencies provided additional information to the Task Force on their agency's responsibilities, related activities, and role in the offshore wind leasing process. These federal agencies included NOAA, USFWS, DOD, and USCG. The meeting included several public input opportunities as well as breakout sessions to allow for additional conversation and coordination.

Between the second and third Task Force meetings, BOEM hosted a series of three in-person meetings in Massachusetts, New Hampshire, and Maine and six virtual meetings targeted toward specific interested party groups to solicit feedback on the draft Call Area and Wind Energy Area model that was developed in collaboration with NOAA's National Center for Coastal and Ocean Science. The virtual meetings were designed for specific interested party groups including shipping and commercial maritime, numerous types of fisheries, environmental non-governmental organizations, and Tribal Nations. From these meetings, BOEM was able to identify themes and key topics from each of the interested party groups to inform the planning process.

The third Task Force meeting, held on May 10 and 11, 2023, was conducted in person with a livestream option. The primary goal was to provide information on the next steps of the commercial leasing process and Maine's research lease application. Presentations on the first day focused on the leasing process, floating wind technology, marine mammals, offshore wind site characterization, and transmission. On the second day, presentations covered the commercial leasing process, wind spatial planning, research lease application, port access route study, engagement opportunities, and each state's perspective on the development of offshore wind in the Gulf of Maine.

Additional information on each of the Task Force meetings, including presentations, summaries, and video recordings, can be found on BOEM's Gulf of Maine web page under Public Engagement at https://www.boem.gov/renewable-energy/state-activities/maine/gulf-maine.

6.1.2 Notice of Intent to Prepare an EA

On May 4, 2023, BOEM released an NOI to Prepare this EA for a wind energy research lease on the Atlantic OCS offshore Maine. To ensure transparency and gather input from interested parties, BOEM published the NOI in the *Federal Register*, inviting public participation. Specifically, BOEM requested public comment on potential environmental issues and alternatives that should be considered during the EA process. This public scoping comment period was open through June 5, 2023.

During the 30-day comment period, BOEM received 28 unique comment submissions from representatives of a Tribal Government; federal, state, or regional government entities; business associations; advocacy groups; and the general public. Key topics raised in the comments include:

- Concerns from USCG and shipping operators citing potential maritime navigational challenges and hazards resulting from the location of the potential research lease in relation to USCG's existing shipping lanes and proposed shipping fairway in the Gulf of Maine
- Concerns raised by commercial fishing groups and individuals about potential space-use conflicts and collision risks within fishing grounds resulting from additional vessel traffic related to offshore wind activities
- Concerns raised about the potential impacts of the Proposed Action on protected species and their habitats and requests for adherence to project design criteria and best management practices for site assessment and site characterization activities to avoid, minimize, mitigate, and monitor impacts
- Requests for BOEM to consider various available data on vessel traffic, fishing activities, benthic habitat types, and species distribution in siting the research lease

A large number of comments raised topics beyond the scope of this EA, including potential future offshore wind development in the Gulf of Maine for research and commercial purposes. These comments expressed concerns or provided information relevant to impacts of potential future offshore wind development in the Gulf of Maine and requested that BOEM prepare an environmental impact statement prior to authorizing construction within the research lease to further analyze potential impacts. Some comments requested thorough assessment of baseline conditions and monitoring throughout installation and operation of the Research Array prior to further consideration of commercial leasing. Other comments expressed general opposition or support for offshore wind energy development.

The comments can be viewed at www.regulations.gov by searching for docket ID BOEM-2023-0031-0001.

6.2 Consultations

6.2.1 Endangered Species Act

In accordance with Section 7(a)(2) of the ESA of 1973, as amended (16 U.S. Code 1531 et seq.), it is mandatory for every federal agency to ensure that any action authorized, funded, or carried out by the agency does not put the continued existence of endangered or threatened species at risk or lead to the destruction or adverse modification of critical habitat for these species. In cases where the action of the federal agency may affect a protected species or its critical habitat, the agency is required to engage in consultation with either NMFS or USFWS, depending on the specific protected species involved.

For the activities addressed in this EA that could potentially affect protected species, BOEM has engaged in informal consultation with both USFWS and NMFS, as per their respective jurisdiction. The current status of consultations with each of these services is outlined below.

6.2.1.1 U.S. Fish and Wildlife Service

BOEM prepared a BA evaluating species and critical habitat under the jurisdiction of USFWS that could be affected by the Proposed Action. BOEM submitted the BA to USFWS on July 21, 2023, and requested concurrence with BOEM's determination that the impacts of the Proposed Action are expected to be discountable and insignificant and thus not likely to adversely affect ESA-listed bird and bat species. BOEM will continue to consult with USFWS concurrently with the NEPA process.

6.2.1.2 National Marine Fisheries Service

BOEM prepared another BA evaluating species and critical habitat under the jurisdiction of NMFS that could be affected by the Proposed Action. As described in the BA, the Proposed Action is subject to project design criteria and best management practices developed through programmatic consultation under Section 7 of the ESA regarding data collection and site survey activities for renewable energy on the Atlantic OCS (BOEM, 2023b). Appendix A of the NMFS BA contains an updated list of project design criteria and best management practices, which will be confirmed through consultation. BOEM submitted the BA to NMFS on July 21, 2023, and requested concurrence with BOEM's determination that the impacts of the Proposed Action are expected to be discountable and insignificant and thus not likely to adversely affect ESA-listed species. BOEM will continue to consult with NMFS concurrently with the NEPA process.

6.2.2 Magnuson-Stevens Fishery Conservation and Management Act

Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act of 1976 requires federal agencies to consult with NMFS on any action that may result in adverse effects on EFH. In accordance with NMFS's provisions outlined in 50 CFR 600 of the Magnuson-Stevens Fishery Conservation and Management Act, BOEM submitted the EFH assessment to NMFS on July 21, 2023, and requested concurrence with BOEM's determination that the impacts of the Proposed Action would not significantly affect the quality and quantity of EFH. BOEM will continue to consult with NMFS concurrently with the NEPA process.

6.2.3 Coastal Zone Management Act

In accordance with the Coastal Zone Management Act, any federal actions that have the potential to affect land or water use or natural resources in the coastal zone must strive to be "consistent to the maximum extent practicable" with the applicable policies outlined in each state's federally approved coastal management program (15 CFR 930 Subpart C). To assess the compatibility of issuing the research lease and conducting site assessment activities in the Gulf of Maine with the enforceable provisions of the Coastal Zone Management Programs of Massachusetts, New Hampshire, and Maine, BOEM prepared consistency determinations under 15 CFR 930.36(a) for each of the three states. The consistency determinations evaluate whether the various activities associated with the Proposed Action align to the maximum extent practicable with the enforceable provisions of the coastal management programs in Massachusetts, New Hampshire, and Maine.

This EA provides the comprehensive data and information required under 30 CFR 939.39 to support BOEM's consistency determinations. BOEM submitted the consistency determinations to each state on July 21, 2023, and requested concurrence with BOEM's determination that the Proposed Action would be consistent to the maximum extent practicable with the enforceable policies of each state.

6.2.4 National Historic Preservation Act (Section 106)

BOEM determined that issuing a research lease within the Gulf of Maine constitutes an undertaking subject to Section 106 of the National Historic Preservation Act (54 U.S. Code 306108) and its implementing regulations (36 CFR 800). The determination is based on the understanding that the resulting site assessment and site characterization activities associated with the Proposed Action have the potential to affect historic properties.

BOEM must consider the potential effects of the Proposed Action and provide the Advisory Council on Historic Preservation with an opportunity to offer its comments.

On June 29, 2023, BOEM formally initiated consultation via letters to the Maine State Historic Preservation Office (SHPO) and the following federally recognized tribes: Houlton Band of Maliseet Indians, Mi'kmaq Nation, Passamaquoddy Tribe of Indians-Indian Township Reservation, Passamaquoddy Tribe of Indians-Pleasant Point Reservation, and Penobscot Indian Nation. BOEM sent a follow-up email to the same tribes on July 12, 2023. Pursuant to 36 CFR 800.3(f), BOEM provided a letter to 97 entities on June 23, 2023, identifying them as potential consulting parties. The entities receiving letters included certified local governments, museums, historic preservation societies, and others. The correspondence sent to the prospective consulting parties sought their public comments and input concerning the identification and potential impacts on historic properties. This was done with the aim of gathering public input for the Section 106 review, as specified in 36 CFR 800.2(d)(3). Additionally, the recipients were invited to actively participate as consulting parties in the review process.

Consistent with 36 CFR 800.4(d)(1), BOEM will prepare a Finding of No Historic Properties Affected for consulting parties, request concurrence on the Finding from the Maine SHPO, and invite comments from other consulting parties. Per 40 CFR 800.4(d)(1)(i), "[i]f the SHPO/[Tribal Historic Preservation Officer], or the [Advisory] Council [on Historic Preservation] if it has entered the Section 106 process, does not object within 30 days of receipt of an adequately documented finding, the agency official's responsibilities under Section 106 are fulfilled."

6.2.5 Consultation and Coordination with Federally Recognized Tribes

Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments*, commits federal agencies to engage in government-to-government consultation with federally recognized tribes when federal actions have tribal implications, and U.S. Department of the Interior policy requires all department bureaus and offices to consult on departmental actions with tribal implications (U.S. Department of the Interior, 2022). A June 29, 2018, memorandum outlines BOEM's current tribal consultation policy (BOEM, 2018). This memorandum states, "consultation is a deliberative process that aims to create effective collaboration and informed federal decision-making" and is in keeping with the spirit and intent of Executive Order 13175 (BOEM, 2018). BOEM implements tribal consultation policies through formal government-to-government consultation, informal dialogue, collaboration, and other engagement.

BOEM initiated consultations with 11 federally recognized Native American tribes with historical and cultural ties to the region under consideration in this EA:

- Houlton Band of Maliseet Indians
- Mashantucket (Western) Pequot Tribal Nation
- Mashpee Wampanoag Tribe
- Mi'kmaq Nation
- Mohegan Tribe of Indians of Connecticut
- Narragansett Indian Tribe
- Passamaquoddy Tribe of Indians – Indian Township
- Passamaquoddy Tribe of Indians – Pleasant Point
- Penobscot Indian Nation
- Shinnecock Indian Nation
- Wampanoag Tribe of Gay Head (Aquinnah)

BOEM invited tribes to be part of the Task Force and participate in the Task Force meetings in 2022 and 2023. Representatives from Shinnecock Indian Nation and Mashpee Wampanoag Tribe attended the May 19, 2022, Task Force meeting.

On September 21, 2022, BOEM attended the EPA Region 1 Regional Tribal Operations Committee meeting and presented on BOEM's RFCI and research lease process.

On December 12, 2022, BOEM staff met with Penobscot Nation representatives to discuss the two Gulf of Maine processes and learn more about their concerns. Representatives raised concerns about impacts on anadromous fish, subsistence hunting and fishing rights, and environmental restoration.

On April 20 and 21, 2023, BOEM's Director and Chief of the Office of Renewable Energy Programs met with tribal leaders from Wampanoag Tribe of Gay Head (Aquinnah), Passamaquoddy Tribe, Pleasant Point and Indian Township, Narragansett Indian Tribe, Mashantucket (Western) Pequot Tribal Nation, Penobscot Indian Nation, Shinnecock Indian Nation, Mohegan Tribe of Connecticut, Houlton Band of Maliseet Indians, and Mashpee Wampanoag Tribe. Discussion focused on concerns about BOEM's offshore wind energy program, improving tribal consultation and collaboration, the rapid pace of offshore wind development, and the tribes' limited capacity to provide timely feedback.

On April 30, 2023, BOEM notified the same tribal leaders and the Mi'kmaq Nation of the *Federal Register* NOI to prepare an EA for the State of Maine's research lease.

At the May 10, 2023, Task Force meeting, tribal representatives from the Passamaquoddy Tribe of Indians, Indian Township and Pleasant Point, Penobscot Nation, and Houlton Band of Maliseet Indians offered comments on BOEM's Gulf of Maine processes. Comments focused on the importance of involving tribes in the process, seeking assurance that BOEM will properly identify and avoid submerged paleo-cultural heritage, concerns about potential increased use of a road leading to Eastport, concerns about having enough time and resources to engage in the process, and a strong desire to ensure no negative impacts on ecosystems and fishing livelihoods.

BOEM is also consulting with tribes as part of the Section 106 of the National Historic Preservation Act process (see Section 6.2.4).

7 List of Preparers

Table 7-1. BOEM contributors

Name	Role/Resource Area
NEPA Coordinator	
Boatman, Mary	NEPA and Science Coordinator
Resource Scientists and Contributors	
Baker, Kyle	Marine Mammals; Sea Turtles
Bosyk, Jennifer	NEPA Compliance
Price, Franklin	Underwater Archaeology
Stokely, Sarah	Cultural Resources and Section 106 Lead
Jensen, Brandon	Benthic Resources; Finfish, Invertebrates, and EFH; Commercial and Recreational Fishing; Other Uses
Wolf, Jacob	Air and Water Quality

Table 7-2. Cooperating Agency Reviewers

Name	Role/Resource Area
BSEE	
Heckman, Andrea	Biologist
Tuttle, Graham	Protected Species Ecologist
NOAA	
Susan Tuxbury	Fishery Biologist
USCG	
DesAutels, Michele	Chief, Maritime Energy and Marine Planning
Sparkman, Chris	Marine Information Specialist

Table 7-3. Consultants

Name	Role/Resource Area
ICF	
Boyd, Victoria	Water Quality

Name	Role/Resource Area
Byram, Saadia	Lead Editor and Publications Specialist
Copeland, Tanya	NEPA Lead
Cox, Deneisha	Administrative Record Lead
Cwalinski, Emma	Public Involvement Support
Ericson, William	NEPA Compliance
Ernst, David	Air Quality and Climate Lead
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Hatfield, Teresa	Navigation and Vessel Traffic
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Lassell, Susan	Section 106 Lead
Mendoza, Tiffany	Public Involvement Lead
Nally, Dan	Project Manager
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Osani, Sam	Cultural Resources and Section 106 Support
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Read, Brent	GIS Lead
Wheaton, Jenna	Section 106 Support
Zaccagnino, Jimmy	Comment Analysis; Other Support
CSA Ocean Sciences Inc.	
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Martin, Tony	Finfish, Invertebrates, and EFH Assessment Lead
McMahon, Adrianna	Benthic Resources
Murray, Deb	Document Processing
Olsen, Kim	Project Manager
Stevens, Tara	Marine Mammals
Tiggelaar, John	Commercial and Recreational Fishing

Appendix A: Vessel Trips and Scenarios

Table A-1. Distances to nearest ports (nautical miles)

Port	1-Way[1]	Roundtrip[1]
Boothbay, ME	40	80
Boston, MA	100	200
Bristol, ME	45	90
Plymouth, MA	110	220
Portland, ME	50	100

[1] One-way trip distances outside the Research Lease Area were approximated by measuring the distance from each port to the farthest corner of the Research Lease Area. This distance was doubled to estimate roundtrip distance.

Table A-2. Site assessment and characterization activities: vessel and aircraft trip lengths and transit speeds

Survey or Monitoring Activity	Modeled Vessel Type[1]	Port	Roundtrip (per-trip) Distance Outside the RLA[2] (nm)	Roundtrip (per-trip) Distance Inside the RLA (nm)	Vessel Speed Outside the RLA[3] (knots)	Vessel Speed Inside the RLA[4] (knots)
FLiDAR Buoy-based Acoustic Monitoring[5]	Crew and Supply	Boston, MA	200	40	22.1	12
Geophysical Reconnaissance Surveys	Tugboat[6]	Portland, ME	100	1,473	11.5	4.5
	Tugboat[7]	Portland, ME	100	69	11.5	4.5
High-Resolution Geophysical Surveys	Tugboat[6]	Portland, ME	100	1,473	11.5	4.5
	Tugboat[7]	Portland, ME	100	69	11.5	4.5
Geotechnical Surveys	Tugboat[6]	Portland, ME	100	1,473	11.5	4.5
Benthic Surveys	--	--	--	--	--	--
Seafloor Habitat Characterization Sampling and Surveys[8]	Work Boat	Boothbay, ME	80	79	12.5	4.5
Physical Oceanographic Monitoring[5]	Work Boat	Portland, ME	100	20	12.5	12.5
Digital Aerial Surveys[9]	4-Place Piston Engine Aircraft	Plymouth, MA	220	140	120	120
Visual Wildlife Surveys[10]	Crew and Supply	Portland, ME	100	50	22.1	10
Passive Acoustic Monitoring of Marine Mammals and Ambient Noise[10]	Work Boat	Boothbay, ME	80	40	12.5	10
Motus Tracking	--	--	--	--	--	--
Active Acoustic Surveys and Environmental DNA (eDNA) Sampling of Marine Fish and Invertebrates[10]	Fishing (C1/C2)	Portland, ME	100	50	12.5	10
Passive Acoustic Monitoring of Large Pelagic and Benthic Fish[10]	Work Boat	Portland, ME	100	50	12.5	10

Survey or Monitoring Activity	Modeled Vessel Type[1]	Port	Roundtrip (per-trip) Distance Outside the RLA[2] (nm)	Roundtrip (per-trip) Distance Inside the RLA (nm)	Vessel Speed Outside the RLA[3] (knots)	Vessel Speed Inside the RLA[4] (knots)
Bottom Trawl Surveys for Marine Fish and Invertebrates[10]	Fishing (C1/C2)	Boothbay, ME	80	40	12.5	2.5
Plankton and Larval Lobster Surveys[10]	Work Boat	Boothbay, ME	80	40	12.5	2.5
Lobster Trawl Surveys[10]	Fishing (C1/C2)	Bristol, ME	90	45	12.5	2.5
Gillnet Survey[10]	Fishing (C1/C2)	Portland, ME	100	50	12.5	2.5

[1] Vessel types provided in Table 2-1 were compared to representative harbor craft vessel types provided in Table 4.1 of EPA, 2022c.
[2] One-way trip distances outside of the RLA were approximated by measuring the distance from each port to the farthest corner of the RLA. This distance was doubled to estimate roundtrip distance.
[3] Vessel speeds outside the RLA were sourced from Table A-4 of BOEM, 2021a. The modeled vessel types from EPA, 2022c were compared to representative vessel types from BOEM, 2021a, respectively, as follows: "Crew and Supply" as "Crew," "Tugboat" as "Tug," "Workboat" as "Research/survey," and "Fishing C1/C2" as "Research/survey."
[4] Vessel speeds inside the RLA were assumed based on project information from Table 2-1 or appropriate estimates specific to each survey or monitoring activity. Vessel speeds inside the RLA were assumed to be 12 knots for FLiDAR buoy-based acoustic monitoring, 4.5 knots for G&G surveys, 12.5 knots for physical oceanographic monitoring, 120 knots for digital aerial surveys, 10 knots for visual wildlife surveys, 10 knots for acoustic surveys and monitoring, and 2.5 knots for fish and trawl surveys.
[5] Roundtrip distance inside the RLA assumed to equal 20% of roundtrip distance outside the RLA.
[6] Roundtrip distance inside the RLA is based on a 14-day (336-hour) trip, with 8.7 hours of traveling outside the RLA (100 nm at 11.5 knots) and the remaining travel distance equal to 327.3 hours traveling at 4.5 knots.
[7] Roundtrip distance inside the RLA is based on a 1-day (24-hour) trip, with 8.7 hours of traveling outside the RLA (100 nm at 11.5 knots) and the remaining travel distance equal to 15.3 hours traveling at 4.5 knots.
[8] Roundtrip distance inside the RLA is based on a 1-day (24-hour) trip, with 6.4 hours of traveling outside the RLA (80 nm at 12.5 knots) and the remaining travel distance equal to 17.6 hours traveling at 4.5 knots.
[9] Roundtrip distance inside the RLA includes 80 nm for maneuvering. An additional 20% of the total roundtrip distance inside and outside the RLA (300 nm * 20% = 60 nm) was added to the distance inside the RLA.
[10] Roundtrip distance inside the RLA assumed to equal 50% of roundtrip distance outside the RLA.
RLA = Research Lease Area

Table A-3. Site assessment and characterization activities: vessel and aircraft trips and activity hours

Survey or Monitoring Activity	Start Date	End Date	Total Trips	Vessel Trips per Year[1]							Vessel Activity Hours per Year[2]						
				2022	2023	2024	2025	2026	2027	2028	2022	2023	2024	2025	2026	2027	2028
FLiDAR Buoy-based Acoustic Monitoring	Mar-24	Feb-26	4	-	-	2	1	1	-	-	-	-	25	12	12	-	-
Geophysical Reconnaissance Surveys	Sep-23	Nov-23	15	-	15	-	-	-	-	-	-	5,040	-	-	-	-	-
	Sep-23	Nov-23	60	-	60	-	-	-	-	-	-	1,440	-	-	-	-	-
High-Resolution Geophysical Surveys	Mar-24	Oct-24	15	-	-	15	-	-	-	-	-	-	5,040	-	-	-	-
	Mar-24	Oct-24	60	-	-	60	-	-	-	-	-	-	1,440	-	-	-	-
Geotechnical Surveys	Mar-24	Oct-24	30	-	-	30	-	-	-	-	-	-	10,080	-	-	-	-
Benthic Surveys	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Seafloor Habitat Characterization Sampling and Surveys	Jan-23	Sep-28	60	-	10	10	10	10	10	10	-	240	240	240	240	240	240
Physical Oceanographic Monitoring	Jul-23	Sep-28	63	-	6	12	12	12	12	9	-	58	115	115	115	115	86
Digital Aerial Surveys	Apr-23	Mar-25	24	-	9	12	3	-	-	-	-	27	36	9	-	-	-
Visual Wildlife Surveys	Jan-23	Sep-28	138	-	24	24	24	24	24	18	-	229	229	229	229	229	171
Passive Acoustic Monitoring of Marine Mammals and Ambient Noise	Jul-23	Sep-28	48	-	8	8	8	8	8	8	-	83	83	83	83	83	83
Motus Tracking	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Active Acoustic Surveys and Environmental DNA (eDNA) Sampling of Marine Fish and Invertebrates	Sep-22	Sep-28	73	4	12	12	12	12	12	9	52	156	156	156	156	156	117
Passive Acoustic Monitoring of Large Pelagic and Benthic Fish	Oct-22	Sep-28	56	8	8	8	8	8	8	8	104	104	104	104	104	104	104
Bottom Trawl Surveys for Marine Fish and Invertebrates	Sep-23	Sep-28	122	-	8	24	24	24	24	18	-	179	538	538	538	538	403
Plankton and Larval Lobster Surveys	Jul-23	Sep-28	126	-	12	24	24	24	24	18	-	269	538	538	538	538	403
Lobster Trawl Surveys	Sep-23	Sep-28	122	-	8	24	24	24	24	18	-	202	605	605	605	605	454
Gillnet Survey	Sep-23	Sep-25	50	-	8	24	18	-	-	-	-	224	672	504	-	-	-
		Totals:[3]	1,066	12	188	289	168	147	146	116	156	8,250	19,900	3,132	2,619	2,607	2,062

[1] The maximum potential number of total vessel trips and aircraft trips were assumed for each site assessment and characterization activity.
[2] For site assessment and characterization activities that do not have specified trip durations, vessel activity hours were calculated by dividing the vessel trip length by the vessel speed for each activity.
[3] Totals may not add due to rounding.

Appendix B: Air Emission Calculations

Table B-1. Site assessment and characterization activities: summary of project emissions by year

Year	NO_X (tons)	PM_{10} (tons)	$PM_{2.5}$ (tons)	VOC (tons)	CO (tons)	SO_2 (tons)	CO_2 (metric tons)	CH_4 (metric tons)	N_2O (metric tons)	CO_2e[1] (metric tons)
2022	0.581	0.014	0.014	0.020	0.100	0.0004	35.376	0.0004	0.0017	35.9
2023	184.307	3.072	2.980	2.289	34.050	0.0894	8,749.1	0.0398	0.4278	8,877.6
2024	467.193	7.754	7.520	5.704	86.042	0.2252	22,128.3	0.0990	1.0821	22,453.2
2025	15.263	0.348	0.337	0.468	2.604	0.0096	921.98	0.0081	0.0452	935.6
2026	12.115	0.280	0.272	0.378	2.015	0.0074	732.08	0.0065	0.0359	742.9
2027	12.045	0.279	0.270	0.377	2.003	0.0074	727.97	0.0065	0.0357	738.8
2028	9.298	0.217	0.210	0.294	1.552	0.0057	562.26	0.0051	0.0276	570.6
Totals:[2]	700.802	11.963	11.603	9.530	128.365	0.345	33,857.1	0.165	1.656	34,354.7

[1] Global Warming Potential: CO_2 = 1; N_2O = 298; CH_4 = 25
[2] Totals may not add due to rounding.
CH_4 = methane; CO_2 = carbon dioxide; N_2O = nitrous oxide

Table B-2. Site assessment and characterization activities: project emissions by activity

Survey or Monitoring Activity	Modeled Vessel Type[1]	NO_X (tons)	PM_{10} (tons)	$PM_{2.5}$ (tons)	VOC (tons)	CO (tons)	SO_2 (tons)	CO_2 (metric tons)	CH_4 (metric tons)	N_2O (metric tons)	CO_2e[4] (metric tons)
FLiDAR Buoy-based Acoustic Monitoring	Crew and Supply	0.278	0.006	0.006	0.007	0.045	0.0002	16.43	0.0001	0.0008	16.7
Geophysical Reconnaissance Surveys	Tugboat	137.198	2.246	2.179	1.582	25.262	0.0652	6,433.2	0.0274	0.3146	6,527.6
	Crew and Supply	39.192	0.642	0.622	0.452	7.216	0.0186	1,837.7	0.0078	0.0899	1,864.7
High-Resolution Geophysical Surveys	Tugboat	137.198	2.246	2.179	1.582	25.262	0.0652	6,433.2	0.0274	0.3146	6,527.6
	Crew and Supply	39.192	0.642	0.622	0.452	7.216	0.0186	1,837.7	0.0078	0.0899	1,864.7
Geotechnical Surveys	Tugboat	274.397	4.493	4.358	3.165	50.524	0.1304	12,866.3	0.0548	0.6292	13,055.2
Benthic Surveys[2]	--	--	--	--	--	--	--	--	--	--	--
Seafloor Habitat Characterization Sampling and Surveys	Work Boat	3.567	0.103	0.100	0.158	0.660	0.0022	219.44	0.0027	0.0109	222.7
Physical Oceanographic Monitoring	Work Boat	1.498	0.043	0.042	0.066	0.277	0.0009	92.17	0.0011	0.0046	93.6
Digital Aerial Surveys	4-Place Piston Engine Aircraft	0.072	0.003	0.002	0.017	0.679	0.0019	5.14	0.0007	0.0000	5.2
Visual Wildlife Surveys	Crew and Supply	7.382	0.156	0.151	0.193	1.205	0.0044	435.98	0.0033	0.0213	442.4
Passive Acoustic Monitoring of Marine Mammals and Ambient Noise	Work Boat	1.236	0.036	0.035	0.055	0.229	0.0008	76.07	0.0009	0.0038	77.2
Motus Tracking[3]	--	--	--	--	--	--	--	--	--	--	--
Active Acoustic Surveys and Environmental DNA (eDNA) Sampling of Marine Fish and Invertebrates	Fishing (C1/C2)	5.910	0.127	0.123	0.164	0.950	0.0036	356.36	0.0028	0.0174	361.6
Passive Acoustic Monitoring of Large Pelagic and Benthic Fish	Work Boat	1.803	0.052	0.051	0.080	0.333	0.0011	110.94	0.0014	0.0055	112.6
Bottom Trawl Surveys for Marine Fish and Invertebrates	Fishing (C1/C2)	17.019	0.366	0.355	0.472	2.734	0.0104	1,026.2	0.0081	0.0502	1,041.4
Plankton and Larval Lobster Surveys	Work Boat	6.991	0.203	0.197	0.310	1.293	0.0044	430.11	0.0054	0.0213	436.6
Lobster Trawl Surveys	Fishing (C1/C2)	19.147	0.412	0.399	0.531	3.076	0.0117	1,154.5	0.0091	0.0565	1,171.5
Gillnet Survey	Fishing (C1/C2)	8.719	0.187	0.182	0.242	1.401	0.0053	525.72	0.0041	0.0257	533.5
	Totals:[5]	700.802	11.963	11.603	9.530	128.365	0.345	33,857.1	0.165	1.656	34,354.7

[1] Vessel types provided in Table 2-1 were compared to representative harbor craft vessel types provided in Table 4.1 of EPA, 2022c.
[2] Benthic surveys would be conducted as part of the G&G surveys. Emissions generated by benthic surveys are included in G&G survey activities.
[3] Motus tracking would be conducted as part of the FLiDAR buoy development and decommissioning. Emissions generated by Motus tracking are included in FLiDAR buoy-based acoustic monitoring activity.
[4] Global Warming Potential: CO_2 = 1; N_2O = 298; CH_4 = 25
[5] Totals may not add due to rounding.
CH_4 = methane; CO_2 = carbon dioxide; N_2O = nitrous oxide

Table B-3. Site assessment and characterization activities: vessel and aircraft load factors and emission factors

Survey or Monitoring Activity	Modeled Vessel Type[6]	Engine Power[1]		Engine Load Factor[2]		Propulsion Engine Emission Factors[3,4,5]									Auxiliary Engine Emission Factors[3,4,5]								
		Average Installed Propulsion Power (kW)	Average Installed Auxiliary Power (kW)	Propulsion Engine Load Factor	Auxiliary Engine Load Factor	NO_X (g/kWh)	PM_{10} (g/kWh)	$PM_{2.5}$ (g/kWh)	VOC (g/kWh)	CO (g/kWh)	SO_2 (g/kWh)	CO_2 (g/kWh)	CH_4 (g/kWh)	N_2O (g/kWh)	NO_X (g/kWh)	PM_{10} (g/kWh)	$PM_{2.5}$ (g/kWh)	VOC (g/kWh)	CO (g/kWh)	SO_2 (g/kWh)	CO_2 (g/kWh)	CH_4 (g/kWh)	N_2O (g/kWh)
FLiDAR Buoy-based Acoustic Monitoring	Crew and Supply	1,037	50	0.45	0.43	10.4535	0.2172	0.2107	0.2709	1.7101	0.00625	679.47	0.0051	0.03323	10.0806	0.2917	0.2829	0.3023	1.5691	0.00625	679.47	0.0057	0.03323
Geophysical Reconnaissance Surveys	Tugboat	3,512	285	0.5	0.43	13.36	0.2099	0.2036	0.1411	2.48	0.00625	679.47	0.0027	0.03323	10.0806	0.2917	0.2829	0.3023	1.5691	0.00625	679.47	0.0057	0.03323
	Tugboat	3,512	285	0.5	0.43	13.36	0.2099	0.2036	0.1411	2.48	0.00625	679.47	0.0027	0.03323	10.0806	0.2917	0.2829	0.3023	1.5691	0.00625	679.47	0.0057	0.03323
High-Resolution Geophysical Surveys	Tugboat	3,512	285	0.5	0.43	13.36	0.2099	0.2036	0.1411	2.48	0.00625	679.47	0.0027	0.03323	10.0806	0.2917	0.2829	0.3023	1.5691	0.00625	679.47	0.0057	0.03323
	Tugboat	3,512	285	0.5	0.43	13.36	0.2099	0.2036	0.1411	2.48	0.00625	679.47	0.0027	0.03323	10.0806	0.2917	0.2829	0.3023	1.5691	0.00625	679.47	0.0057	0.03323
Geotechnical Surveys	Tugboat	3,512	285	0.5	0.43	13.36	0.2099	0.2036	0.1411	2.48	0.00625	679.47	0.0027	0.03323	10.0806	0.2917	0.2829	0.3023	1.5691	0.00625	679.47	0.0057	0.03323
Benthic Surveys	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Seafloor Habitat Characterization Sampling and Surveys	Work Boat	464	36	0.45	0.43	10.0757	0.2422	0.2349	0.289	1.6196	0.00625	679.47	0.0055	0.03323	9.253	0.9446	0.9162	2.5418	5	0.00625	679.47	0.0483	0.03869
Physical Oceanographic Monitoring	Work Boat	464	36	0.45	0.43	10.0757	0.2422	0.2349	0.289	1.6196	0.00625	679.47	0.0055	0.03323	9.253	0.9446	0.9162	2.5418	5	0.00625	679.47	0.0483	0.03869
Digital Aerial Surveys[7]	4-Place Piston Engine Aircraft	N/A	N/A	N/A	N/A	903.00	1.20	1.20	197.00	6,743.00	23.00	71,323.0	10.19	0.61	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Visual Wildlife Surveys	Crew and Supply	1,037	50	0.45	0.43	10.4535	0.2172	0.2107	0.2709	1.7101	0.00625	679.47	0.0051	0.03323	10.0806	0.2917	0.2829	0.3023	1.5691	0.00625	679.47	0.0057	0.03323
Passive Acoustic Monitoring of Marine Mammals and Ambient Noise	Work Boat	464	36	0.45	0.43	10.0757	0.2422	0.2349	0.289	1.6196	0.00625	679.47	0.0055	0.03323	9.253	0.9446	0.9162	2.5418	5	0.00625	679.47	0.0483	0.03869
Motus Tracking	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Active Acoustic Surveys and Environmental DNA (eDNA) Sampling of Marine Fish and Invertebrates	Fishing (C1/C2)	909	186	0.52	0.43	10.2471	0.2076	0.2014	0.2805	1.6549	0.00625	679.47	0.0053	0.03323	10.0806	0.2917	0.2829	0.3023	1.5691	0.00625	679.47	0.0057	0.03323
Passive Acoustic Monitoring of Large Pelagic and Benthic Fish	Work Boat	464	36	0.45	0.43	10.0757	0.2422	0.2349	0.289	1.6196	0.00625	679.47	0.0055	0.03323	9.253	0.9446	0.9162	2.5418	5	0.00625	679.47	0.0483	0.03869

Survey or Monitoring Activity	Modeled Vessel Type[6]	Engine Power[1]		Engine Load Factor[2]		Propulsion Engine Emission Factors[3,4,5]									Auxiliary Engine Emission Factors[3,4,5]								
		Average Installed Propulsion Power (kW)	Average Installed Auxiliary Power (kW)	Propulsion Engine Load Factor	Auxiliary Engine Load Factor	NO_X (g/kWh)	PM_{10} (g/kWh)	$PM_{2.5}$ (g/kWh)	VOC (g/kWh)	CO (g/kWh)	SO_2 (g/kWh)	CO_2 (g/kWh)	CH_4 (g/kWh)	N_2O (g/kWh)	NO_X (g/kWh)	PM_{10} (g/kWh)	$PM_{2.5}$ (g/kWh)	VOC (g/kWh)	CO (g/kWh)	SO_2 (g/kWh)	CO_2 (g/kWh)	CH_4 (g/kWh)	N_2O (g/kWh)
Bottom Trawl Surveys for Marine Fish and Invertebrates	Fishing (C1/C2)	909	186	0.52	0.43	10.2471	0.2076	0.2014	0.2805	1.6549	0.00625	679.47	0.0053	0.03323	10.0806	0.2917	0.2829	0.3023	1.5691	0.00625	679.47	0.0057	0.03323
Plankton and Larval Lobster Surveys	Work Boat	464	36	0.45	0.43	10.0757	0.2422	0.2349	0.289	1.6196	0.00625	679.47	0.0055	0.03323	9.253	0.9446	0.9162	2.5418	5	0.00625	679.47	0.0483	0.03869
Lobster Trawl Surveys	Fishing (C1/C2)	909	186	0.52	0.43	10.2471	0.2076	0.2014	0.2805	1.6549	0.00625	679.47	0.0053	0.03323	10.0806	0.2917	0.2829	0.3023	1.5691	0.00625	679.47	0.0057	0.03323
Gillnet Survey	Fishing (C1/C2)	909	186	0.52	0.43	10.2471	0.2076	0.2014	0.2805	1.6549	0.00625	679.47	0.0053	0.03323	10.0806	0.2917	0.2829	0.3023	1.5691	0.00625	679.47	0.0057	0.03323

[1] Average installed propulsion and auxiliary engine powers are sourced from Table G.1 of EPA, 2022c.
[2] Propulsion and auxiliary engine load factors are sourced from Table 4.4 of EPA, 2022c.
[3] Emission factors for NO_X, PM_{10}, $PM_{2.5}$, VOC, CO, and CH_4 were sourced from Table H.6 of EPA, 2022c based on engine power and conservatively assume the use of uncontrolled Tier 0 engines manufactured prior to 1999.
[4] Emission factors for CO_2 and SO_2 were sourced from Table H.7 of EPA, 2022c and assume the use of uncontrolled Tier 0 engines.
[5] Emission factors for N_2O were calculated using Equation 4.3 and Table 4.3 of EPA, 2022c based on engine power.
[6] Vessel types provided in Table 2-1 were compared to representative harbor craft vessel types provided in Table 4.1 of EPA, 2022c.
[7] Four-place piston engine aircraft emissions are provided as cruise mode emission factors, which are based on hours of cruise activity. Emissions per landing and take-off cycle are not included in this table; however, such emissions were included in the emissions calculations.
CH_4 = methane; CO_2 = carbon dioxide; g = grams; kW = kilowatt; kWh = kilowatt-hours; N_2O = nitrous oxide

Table B-4. Inventory of vessel load factors and emission factors

Factor		Ship Type[6]			
		Crew and Supply	Fishing (C1/C2)	Tugboat	Work Boat
Engine Power[1]	Average Installed Propulsion Power (kW)	1,037	909	3,512	464
	Average Installed Auxiliary Power (kW)	50	186	285	36
Engine Load Factor[2]	Propulsion Engine Load Factor	0.45	0.52	0.50	0.45
	Auxiliary Engine Load Factor	0.43	0.43	0.43	0.43
Propulsion Engine Emission Factors[3,4,5]	NO_X (g/kWh)	10.4535	10.2471	13.3600	10.0757
	PM_{10} (g/kWh)	0.2172	0.2076	0.2099	0.2422
	$PM_{2.5}$ (g/kWh)	0.2107	0.2014	0.2036	0.2349
	VOC (g/kWh)	0.2709	0.2805	0.1411	0.2890
	CO (g/kWh)	1.7101	1.6549	2.4800	1.6196
	SO_2 (g/kWh)	0.00625	0.00625	0.00625	0.00625
	CO_2 (g/kWh)	679.47	679.47	679.47	679.47
	CH_4 (g/kWh)	0.0051	0.0053	0.0027	0.0055
	N_2O (g/kWh)	0.033228	0.033228	0.033228	0.03323
Auxiliary Engine Emission Factors[3,4,5]	NO_X (g/kWh)	10.0806	10.0806	10.0806	9.2530
	PM_{10} (g/kWh)	0.2917	0.2917	0.2917	0.9446
	$PM_{2.5}$ (g/kWh)	0.2829	0.2829	0.2829	0.9162
	VOC (g/kWh)	0.3023	0.3023	0.3023	2.5418
	CO (g/kWh)	1.5691	1.5691	1.5691	5.0000
	SO_2 (g/kWh)	0.00625	0.00625	0.00625	0.00625
	CO_2 (g/kWh)	679.47	679.47	679.47	679.47

Factor		Ship Type[6]			
		Crew and Supply	Fishing (C1/C2)	Tugboat	Work Boat
	CH_4 (g/kWh)	0.0057	0.0057	0.0057	0.0483
	N_2O (g/kWh)	0.033228	0.033228	0.033228	0.03869

[1] Average installed propulsion and auxiliary engine powers are sourced from Table G.1 of EPA, 2022c.
[2] Propulsion and auxiliary engine load factors are sourced from Table 4.4 of EPA, 2022c.
[3] Emission factors for NO_X, PM_{10}, $PM_{2.5}$, VOC, CO, and CH_4 were sourced from Table H.6 of EPA, 2022c based on engine power and conservatively assume the use of uncontrolled Tier 0 engines manufactured prior to 1999.
[4] Emission factors for CO_2 and SO_2 were sourced from Table H.7 of EPA, 2022c and assume the use of uncontrolled Tier 0 engines.
[5] Emission factors for N_2O were calculated using Equation 4.3 and Table 4.3 of EPA, 2022c based on engine power.
[6] Vessel types provided in Table 2-1 were compared to representative harbor craft vessel types provided in Table 4.1 of EPA, 2022c.
CH_4 = methane; CO_2 = carbon dioxide; g = grams; kW = kilowatt; kWh = kilowatt-hours; N_2O = nitrous oxide

Table B-5. Aircraft emission factors per transit hour in cruise mode

Aircraft Type	NO_X (g/hour)	PM_{10} (g/hour)	$PM_{2.5}$ (g/hour)	VOC (g/hour)	CO (g/hour)	SO_2 (g/hour)	CO_2 (g/hour)	CH_4 (g/hour)	N_2O (g/hour)
4-Place Piston Engine Aircraft	903.00	1.20	1.20	197.00	6,743.0	23.0	71,323.0	10.19	0.61

Sources: FOCA, 2007; WRI, 2017.
Particulate matter emissions were assumed to equal the rate of soot emissions provided by FOCA, 2007.
VOC emissions were assumed to equal total hydrocarbon emissions provided by FOCA, 2007.
SO_2 emissions were calculated assuming a fuel sulfur content of 0.05% and assuming that 100% of fuel sulfur is converted to SO_2.
CO_2 emissions were calculated assuming 23 kg of fuel is burned per hour (FOCA, 2007) and 3,101 kg of CO_2 emitted per metric ton of aviation gas (WRI, 2017). Therefore, 3.101 kg of CO_2 are emitted per kg of aviation gas. Assuming 23 kg of aviation gas per hour, the CO_2 emission rate is 71.323 kg/hour, or 71,323 g/hour.
CH_4 emissions were calculated assuming 23 kg of fuel is burned per hour (FOCA, 2007) and 0.443 kg of CH_4 emitted per metric ton of aviation gas (WRI, 2017). Therefore, 4.43E-4 kg of CH_4 are emitted per kg of aviation gas. Assuming 23 kg of aviation gas per hour, the CH_4 emission rate is 0.0102 kg/hour, or 10.19 g/hour.
N_2O emissions were calculated assuming 23 kg of fuel is burned per hour (FOCA, 2007) and 0.02658 kg of N_2O emitted per metric ton of aviation gas (WRI, 2017). Therefore, 2.66E-5 kg of N_2O are emitted per kg of aviation gas. Assuming 23 kg of aviation gas per hour, the N_2O emission rate is 6.11E-4 kg/hour, or 0.611 g/hour.
Aircraft emissions are the sum of transit emissions in cruise mode plus one LTO cycle (see table below).
CH_4 = methane; CO_2 = carbon dioxide; kg = kilograms; g = grams; LTO = landing and take-off cycle; N_2O = nitrous oxide

Table B-6. Aircraft emissions per landing and take-off cycle

Aircraft Type	NO_X (g/LTO)	PM_{10} (g/LTO)	$PM_{2.5}$ (g/LTO)	VOC (g/LTO))	CO (g/LTO)	SO_2 (g/LTO)	CO_2 (g/LTO)	CH_4 (g/LTO)	N_2O (g/LTO)
General Aviation Piston Aircraft	29.4835125	107.04783	74.1170145	68.220312	5452.18185	4.535925	0.0	0.0	0.0

Source: EPA, 2016.
CO_2, CH_4, and N_2O emission factors per LTO cycle were not readily available at the time of this analysis, and as such were assumed to be zero.
Aircraft emissions are sum of transit emissions in cruise mode plus one LTO cycle. Aircraft emissions per LTO cycle are generated once per trip.
CH_4 = methane; CO_2 = carbon dioxide; g = grams; LTO = landing and take-off cycle; N_2O = nitrous oxide

Appendix C: Ongoing and Planned Activities Scenario

C.1 Introduction

This appendix discusses ongoing and reasonably foreseeable planned activities that could contribute to impacts on resources in the same location and timeframe as impacts from the Proposed Action. The Proposed Action is issuance of a wind energy research lease in support of wind energy development in the Gulf of Maine. The research lease would not authorize any activities on the OCS but would result in site assessment activities (i.e., placement of a meteorological ocean buoy) within the lease and site characterization activities (i.e., G&G, biological, and archaeological surveys and monitoring activities) within and around the lease and potential future project easements.

This scenario addresses ongoing and planned activities occurring between the start of site assessment and site characterization activities related to the Proposed Action activities that began in September 2022 and may continue until September 2028, assuming that a RAP would be approved within 5 years of lease issuance. **Table 3-1** identifies the GAAs within which ongoing and planned activities were identified.

C.2 Ongoing and Planned Activities

Ongoing and planned activities with IPFs that overlap both spatially and temporally with IPFs from the Proposed Action, and could contribute to cumulative impacts on the same resources, are (1) commercial fisheries; (2) military use; (3) marine transportation; (4) undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); (5) marine minerals use and ocean-dredged material disposal; (6) surveys and monitoring activities; and (7) global climate change.

IPFs identified in **Table 3-2** that could contribute to cumulative impacts are:

- Air emissions
- Noise
- Lighting
- Seafloor disturbance
- Entanglement
- Routine vessel discharges
- Vessel traffic and space-use conflicts

More information about each of the IPFs listed above is provided in BOEM's *National Environmental Policy Act Documentation for Impact-Producing Factors in the Offshore Wind Cumulative Impacts Scenario on the North Atlantic Continental Shelf* (Avanti Corporation and Industrial Economics Inc., 2019); this document is incorporated by reference.

In August 2022, BOEM published an RFI for the Gulf of Maine to identify the offshore locations that appear most suitable for development, solicit public comment on potential impacts on resources and ocean users, and gauge interest in the development of commercial wind energy leases. In response to the RFI, BOEM received nominations of interest from five developers. BOEM used information gained through public comment on the RFI to develop a draft Call Area in partnership with NOAA's National

Center for Coastal and Ocean Science. In April 2023, BOEM announced the publication of the Gulf of Maine's Call for Information and Nominations, which assesses interest in and invites the public to comment on possible commercial wind energy development in the refined Call Area. Currently, no other offshore wind energy development activities, such as construction and operation of wind turbines or site characterization surveys or site assessment activities, other than the Proposed Action are taking place in the Gulf of Maine. Therefore, other offshore wind activities are not included in the ongoing and planned activities scenario.

C.2.1 Commercial Fisheries

NMFS implements regulations to manage commercial and recreational fisheries in federal waters, including those within which the Proposed Action would primarily be located. The Gulf of Maine is within the management area of NEFMC, which includes Maine, New Hampshire, Massachusetts, Rhode Island, and Connecticut. The council manages species with many Fishery Management Plans that are frequently updated, revised, and amended and coordinates internally and with interested parties and the public to jointly manage species across jurisdictional boundaries. Many of the fisheries managed by NEFMC are fished for in state waters or outside of the New England region, so NEFMC works with the Atlantic States Marine Fisheries Commission (ASMFC). ASMFC is composed of the 15 Atlantic coast states and coordinates the management of marine and anadromous resources found in the states' marine waters. ASMFC's *Amendment 3 to the Interstate Fishery Management Plan for American Lobster* cooperatively manages the American lobster resource and fishery with the states and NMFS (Lockhart and Estrella, 1997). NMFS also manages highly migratory species, such as tuna and sharks, which can travel long distances and cross domestic boundaries.

The Fishery Management Plans were established, in part, to manage fisheries to avoid overfishing. They accomplish this through an array of management measures, including annual catch quotas, minimum size limits, and closed areas. These various measures can further reduce (or increase) the size of landings of commercial fisheries in the New England region. Major fisheries in the Gulf of Maine include groundfish, herring, lobster, scallop, soft-shell clam, and tuna (Gulf of Maine Council on the Marine Environment, 2013).

C.2.2 Military Use

Military activities in the region can include various vessel training exercises, submarine and anti-submarine training, and U.S. Air Force exercises. The Boston Range Complex is a surface and subsurface operating area off the Maine, New Hampshire, and Massachusetts coast used for fleet training and testing activities, and consists of associated special use airspace. Airspace Warning Area W-103 overlaps with the GAA and is used for surface and anti-submarine warfare tactics (U.S. Department of the Navy, 2013). The U.S. Navy, U.S. Army, USCG, and U.S. Air Force have major and minor military installations along the Gulf of Maine. Ongoing onshore and offshore activities are anticipated to continue. Ongoing USCG activities in the region include search and rescue missions and response to oil discharges and hazardous substance releases into the navigable waters under the agency's Marine Environmental Protection mission.

C.2.3 Marine Transportation

Marine transportation in the region is diverse and sourced from many ports and private harbors. Commercial vessel traffic in the region includes research, tug/barge, cargo, tanker, charter and cruise ships, smaller passenger vessels, and commercial fishing vessels. Recreational vessel traffic includes private motorboats, fishing boats, and sailboats. Most vessel traffic, excluding recreational vessels, tends to travel within established vessel traffic routes, and the number of trips, as well as the number of unique vessels, has remained consistent (USCG, 2023). As shown on **Figure C-1**, USCG has proposed the addition of six shipping safety fairways within the Gulf of Maine (including one not outside the extent of **Figure C-1**) due to planned or potential offshore development, changes in fishery management and species distribution, and port expansion (USCG, 2023). The proposed Portland Eastern Approach Fairway extends from the terminus of the existing Portland Eastern Approach TSS and would overlap with the majority of the Research Lease Area before connecting with the proposed Gulf of Maine Fairway (USCG, 2023). These recommended fairways will preserve unobstructed transit of densely traveled routes and port approaches and may be utilized by mariners but are not mandatory for any specific class of vessel.

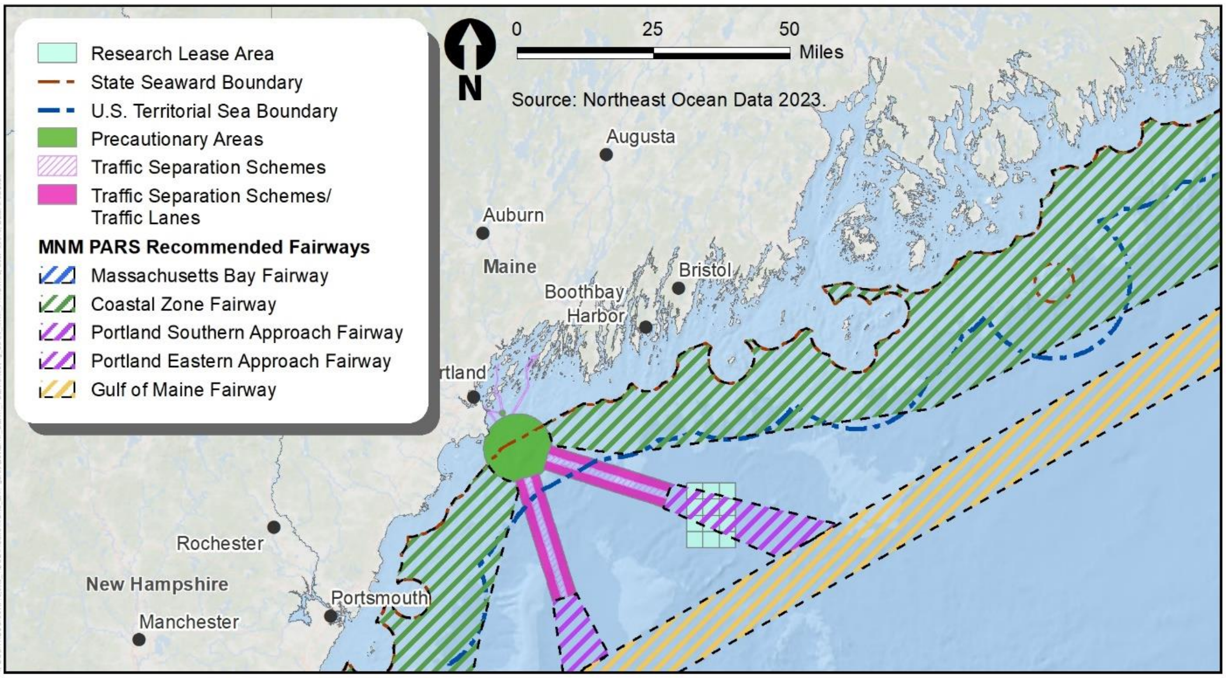

Figure C-1. Approaches to Maine, New Hampshire, and Massachusetts Port Access Route Study recommended fairways

C.2.4 Undersea Transmission Lines, Gas Pipelines, and Other Submarine Cables

Two undersea telecommunication cables, one existing and one planned, are present within the Gulf of Maine. The EXA System, formerly Hibernia Atlantic, connects Massachusetts, Canada, Ireland, and the United Kingdom (NASCA, 2020). Amitié is currently under construction and will connect Massachusetts, France, and the United Kingdom (FCC, 2021). No gas pipelines are present within the Gulf of Maine. BOEM has not identified any additional publicly noticed plans for planned submarine cables or pipelines within the Research Lease Area.

C.2.5 Marine Minerals Use and Ocean-Dredged Material Disposal

BOEM's Marine Minerals Program currently has no active OCS lease areas for sand borrow areas within the Gulf of Maine (BOEM, 2023e). Three BOEM sand resource areas are present offshore New Hampshire in the Gulf of Maine and six sand resource aliquots are present to the north offshore Maine (BOEM, 2023d). Survey efforts are ongoing off the coast of Maine to characterize the seafloor habitat to identify additional marine mineral resources necessary to support beach renourishment projects (Benson and Enterline, 2021).

EPA Region 1 is responsible for designating and managing ocean disposal sites for materials offshore in the Gulf of Maine. USACE issues permits for ocean disposal sites, and all ocean sites are for the disposal of dredged material permitted or authorized under the Marine Protection, Research and Sanctuaries Act. There are five active and a number of inactive or infrequently used open-water disposal sites in the region (USACE, 2023a).

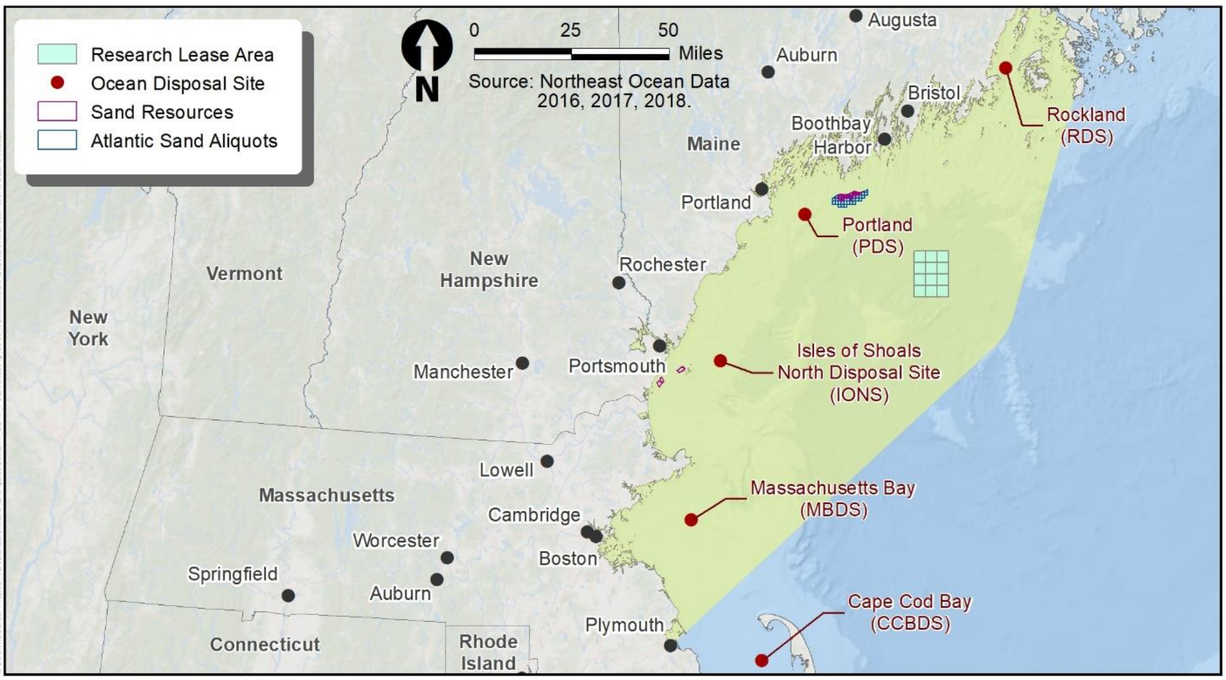

Figure C-2. Marine mineral and ocean disposal sites in the vicinity of the Research Lease Area within the Gulf of Maine

C.2.6 Surveys and Monitoring Activities

Several regional NOAA scientific surveys are conducted within the Gulf of Maine including the Autumn and Spring Bottom Trawl Survey, Ecosystem Monitoring Survey, Marine Mammal and Sea Turtle Aerial Survey, North Atlantic Right Whale Aerial Surveys, Atlantic Surfclam Survey, Ocean Quahog Survey, and Atlantic Sea Scallop Survey (Hare et al., 2022). Additionally, two regional NOAA surveys specific to the Gulf of Maine, the Gulf of Maine Cooperative Research Bottom Longline Survey and the Northern Shrimp Survey, would also overlap the Research Lease Area (Pentony, 2022).

BOEM conducts digital aerial surveys within an approximately 1,648,822-acre (6,672-km^2) survey region surrounding the Research Lease Area to sample and map seasonal occurrence and activity of birds, as well as bats, marine mammals and sea turtles, and large fish. BOEM has funded four broad digital surveys—once per season—beginning in the spring of 2023. BOEM's digital aerial wildlife surveys are conducted by BRI and HiDef with flights based out of Plymouth, Massachusetts (Stantec, 2023).

Passive acoustic monitoring devices are temporarily moored or deployed within the Research Lease Area through the NOAA Northeast Fisheries Science Center, Passive Acoustic Research Program and its partner organizations. Monitoring devices include temporary bottom-mounted moorings, surface buoys, and glider deployments (NEFSC, 2023).

C.2.7 Global Climate Change

Although climate change is not an activity, it could contribute to cumulative impacts when combined with the incremental impacts of the Proposed Action by altering baseline environmental conditions and putting stress on natural ecosystems. Climate change results primarily from the increasing concentration of GHG emissions in the atmosphere, which causes planet-wide physical, chemical, and biological changes, substantially affecting the world's oceans and lands. Changes include increases in global atmospheric and oceanic temperature, shifting weather patterns, rising sea levels, and changes in atmospheric and oceanic chemistry (Blunden and Arndt, 2020).

The Intergovernmental Panel on Climate Change released a special report in October 2018 that compared risks associated with an increase of global warming of 1.5°C and an increase of 2°C. The report found that climate-related risks depend on the rate, peak, and duration of global warming, and that an increase of 2°C was associated with greater risks from climatic changes such as extreme weather and drought; global sea level rise; impacts on terrestrial ecosystems; impacts on marine biodiversity, fisheries, and ecosystems and their functions and services to humans; and impacts on health, livelihoods, food security, water supply, and economic growth (IPCC, 2018).

Current and future impacts of climate change and the way in which they overlap with renewable energy development are described in the *National Environmental Policy Act Documentation for Impact-Producing Factors in the Offshore Wind Cumulative Impacts Scenario on the North Atlantic Continental Shelf* (Avanti Corporation and Industrial Economics Inc., 2019). The *Programmatic Environmental Impact Statement for Alternative Energy Development and Production and Alternate Use of Activities on the Outer Continental Shelf* (MMS, 2007) also assesses potential cumulative effects of global climate change in combination with renewable energy development. These documents are incorporated by reference. Primary impacts from global climate change on resources that could be aggravated by the incremental impacts of the Proposed Action include:

- Potential for algal blooms that deplete the water of oxygen and increase stresses on seagrasses, fish, shellfish, and benthic communities.
- Increasing ocean temperatures, acidification, and salinity resulting in suboptimal conditions for most marine organisms by 2050 in both the surface and bottom conditions (Siedlecki et al., 2021).
- Changes in primary production levels in the ocean affecting fish stock productivity, increasing stress on fish populations, including those harvested by commercial and recreational fishing. Many fish and invertebrate species in the Northeast U.S. Shelf are highly or very highly vulnerable to climate change and climate variability (Hare et al., 2016).

- Impacts on the survival, health, migration, and distribution of marine mammals and sea turtles through impacts on their food supply and breeding habitats.
- Poleward shifts in distribution of marine populations with increasing water temperatures.

Appendix D: Standard Operating Conditions and Mitigation

This section lists the SOCs and mitigation that are part of the Proposed Action. The SOCs and mitigation were developed by BOEM in coordination with cooperating agencies to avoid, minimize, or mitigate potential impacts.

1 General Requirements

1.1 Prior to the start of operations, the Lessee must hold a briefing to establish responsibilities of each involved party, define the chains of command, discuss communication procedures, provide an overview of monitoring procedures, and review operational procedures. This briefing must include all relevant personnel, crew members and protected species observers (PSOs). New personnel must be briefed as they join the work in progress.

1.2 The Lessee must ensure that all vessel operators and crew members, including PSOs, are familiar with, and understand, the requirements specified in Addendum C of the lease.

1.3 The Lessee must ensure that a copy of Addendum C of the lease and the Project Design Criteria and Best Management Practices listed in Appendix B of the NMFS Letter of Concurrence issued by NMFS on June 29, 2021, or as required through new or activity specific consultations, is made available on every project-related vessel. The 2021 BA and letter of concurrence may be found at https://www.boem.gov/environmental-consultations.

1.4 ESA Consultation for Biological Surveys: The Lessee must consult with BOEM, NMFS, and USFWS prior to designing and conducting biological surveys intended to support offshore renewable energy plans that could interact with ESA-listed species. Please see the 2021 BA and letter of concurrence at https://www.boem.gov/renewable-energy/nmfs-esa-consultations for data collection activities that have been previously consulted upon.

2 Protected Species

2.1 Protected Species. Unless otherwise authorized by BOEM, Lessee's OCS activities must comply with the standards in the Project Design Criteria and Best Management Practices of the February 2021 BA and corresponding NMFS Letter of Concurrence issued by NMFS Appendix B on June 29, 2021. The 2021 BA and letter of concurrence may be found here at https://www.boem.gov/renewable-energy/nmfs-esa-consultations. At the Lessee's option, the Lessee, its operators, personnel, and contractors may satisfy this requirement by complying with the NMFS-approved measures to safeguard protected species that are most current at the time an activity is undertaken under this lease, including but not limited to new or updated versions of the 2021 BA or 2021 NMFS Letter of Concurrence, or through new or activity-specific consultations.

3 Archaeological Survey Requirements

3.1 Archaeological Survey Required. The Lessee must provide the results of an archaeological survey with its plans.

3.2 Qualified Marine Archaeologist. The Lessee must ensure that the analysis of archaeological survey data collected in support of plan (e.g., SAP and/or Construction and Operations Plan) submittal and the preparation of archaeological reports in support of plan submittal are conducted by a Qualified Marine Archaeologist.

3.3 Tribal Pre-Survey Meeting. The Lessee must coordinate a tribal pre-survey meeting by sending a letter through certified mail, and following up with email or phone calls as necessary, to the following Tribes:

- Houlton Band of Maliseet Indians;
- Mashantucket (Western) Pequot Tribal Nation;
- Mashpee Wampanoag Tribe;
- Mi'kmaq Nation;
- Mohegan Tribe of Indians of Connecticut;
- Narragansett Indian Tribe;
- Passamaquoddy Tribe of Indians- Indian Township Reservation;
- Passamaquoddy Tribe of Indians- Pleasant Point Reservation;
- Penobscot Indian Nation;
- Shinnecock Indian Nation; and
- Wampanoag Tribe of Gay Head (Aquinnah).

The purpose of this meeting will be for the Lessee and the Lessee's Qualified Marine Archaeologist to discuss the Lessee's Survey Plan and consider requests to monitor portions of the archaeological survey and the geotechnical exploration activities, including the visual logging and analysis of geotechnical samples (e.g., cores, etc.). Notification of the tribal pre-survey meeting must be sent at least 15 calendar days prior to the date of the proposed tribal pre-survey meeting. The meeting must be scheduled for a date at least 30 calendar days prior to commencement of survey activities performed in support of plan submittal and at a location and time that affords the participants a reasonable opportunity to participate. The anticipated date for the meeting must be identified in the timeline of activities described in the applicable survey plan (see 2.1 of the lease). The Lessee must provide the Lessor with documentation of compliance with this stipulation prior to commencement of surveys.

3.4 Geotechnical Exploration. The Lessee may only conduct geotechnical exploration activities performed in support of plan (i.e., SAP and/or Construction and Operations Plan) submittal in locations where an analysis of the results of geophysical surveys has been completed. This analysis must include a determination by a Qualified Marine Archaeologist as to whether any potential archaeological resources are present in the area. Except as allowed by the Lessor under 4.2.6, the geotechnical exploration activities must avoid potential archaeological resources by a minimum of 50 meters (164 feet), and the avoidance distance must be calculated from the maximum discernible extent of the archaeological resource. A Qualified Marine Archaeologist must certify, in the Lessee's archaeological reports, that geotechnical exploration activities did not impact potential historic properties identified as a result of the HRG surveys performed in support of plan submittal, except as follows: in the event that the geotechnical exploration activities did impact potential historic properties identified in the archaeological surveys without the Lessor's prior approval, the Lessee and the Qualified Marine Archaeologist who prepared the report must instead provide a statement documenting the extent of these impacts.

3.5 Monitoring and Avoidance. The Lessee must inform the Qualified Marine Archaeologist that he or she may elect to be present during HRG surveys and bottom-disturbing activities performed in support of plan (i.e., SAP and/or Construction and Operations Plan) submittal to ensure avoidance of potential archaeological resources, as determined by the Qualified Marine Archaeologist (including bathymetric, seismic, and magnetic anomalies; side scan sonar contacts; and other seafloor or sub-surface features that exhibit potential to represent or contain potential archaeological sites or other historic properties). In the event that the Qualified Marine Archaeologist indicates that he or she wishes to be present, the Lessee must reasonably facilitate the Qualified Marine Archaeologist's presence, as requested by the Qualified Marine Archaeologist, and provide the Qualified Marine Archaeologist the opportunity to inspect data quality.

3.6 No Impact without Approval. In no case may the Lessee knowingly impact a potential archaeological resource without the Lessor's prior approval.

3.7 Post-Review Discovery Clauses. If the Lessee, while conducting geotechnical exploration or any other bottom-disturbing site characterization activities in support of plan (i.e., SAP and Construction and Operations Plan) submittal and after review of the location by a Qualified Marine Archaeologist under 4.2.4 of the lease, discovers an unanticipated potential archaeological resource, such as the presence of a shipwreck (e.g., a sonar image or visual confirmation of an iron, steel, or wooden hull, wooden timbers, anchors, concentrations of historic objects, piles of ballast rock) or evidence of a pre-contact archaeological site (e.g. stone tools, pottery or other pre-contact artifacts) within the project area, the Lessee must:

3.7.1 Immediately halt seafloor/bottom-disturbing activities within the area of discovery;

3.7.2 Notify the Lessor within 24 hours of discovery;

3.7.3 Notify the Lessor in writing via report to the Lessor within 72 hours of its discovery;

3.7.4 Keep the location of the discovery confidential and take no action that may adversely impact the archaeological resource until the Lessor has made an evaluation and instructs the applicant on how to proceed; and

3.7.5 If (1) the site has been impacted by the Lessee's project activities; or (2) impacts to the site or to the area of potential effect cannot be avoided, conduct additional investigations, as directed by the Lessor, to determine if the resource is eligible for listing in the National Register of Historic Places (30 CFR 585.802(b)). If investigations indicate that the resource is potentially eligible for listing in the National Register of Historic Places, the Lessor will inform the Lessee how to protect the resource or how to mitigate adverse effects to the site. If the Lessor incurs costs in protecting the resource, then, under Section 110(g) of the National Historic Preservation Act, the Lessor may charge the Lessee reasonable costs for carrying out preservation responsibilities under the OCS Lands Act (30 CFR 585.802(c-d)).

4 Avian and Bat Survey and Reporting Requirements

4.1 Lighting: Any lights used to aid marine navigation by the Lessee during construction, operations, and decommissioning of a meteorological buoy must meet USCG requirements for private aids to navigation [https://www.navcen.uscg.gov/pdf/AIS/CG_2554_Paton.pdf] and BOEM's Guidelines for Lighting and Marking of Structures Supporting Renewable Energy Development [https://www.boem.gov/2021-lighting-and-marking-guidelines]. For any additional lighting, the Lessee must use such lighting only when necessary, and the lighting must be hooded downward and directed when possible, to reduce upward illumination and illumination of adjacent waters.

4.2 Motus Wildlife Tracking System: To help address information gaps on offshore movements of birds and bats, including ESA-listed species, the Lessee must install Motus stations on meteorological or environmental data buoys in coordination with USFWS's Offshore Motus network.

4.3 Bird Deterrents: To minimize the attraction of birds, the Lessee must install bird deterrent devices (e.g., anti-perching), where appropriate.

4.4 Avian Annual Reporting: The Lessee must provide an annual report to the Lessor and USFWS using the contact information provided as an Enclosure to this lease, or updated contact information as provided by the Lessor. This report must document any dead or injured birds or bats found during activities conducted in support of plan submittal. The first report must be submitted within 6 months of the start of the first survey conducted in support of plan submittal, and subsequent reports must be submitted annually thereafter until all surveys in support of plan submittal have concluded and all such birds and bats have been reported. If surveys are not conducted in a given year, the annual report may consist of a simple statement to that effect. An annual report must be provided to BOEM and USFWS documenting any dead (or injured) birds or bats found on vessels and structures during construction, operations, and decommissioning. The report must contain the following information: the name of species, date found, location, a picture to confirm species identity (if possible), and any other relevant information. Carcasses with Federal or research bands must be reported to the United States Geological Survey Bird Band Laboratory, available at https://www.usgs.gov/centers/eesc/science/bird-banding-laboratory.

4.5 Immediate Reporting: Any occurrence of dead or injured ESA-listed birds or bats must be reported to BOEM, BSEE, and USFWS as soon as practicable (taking into account crew and vessel safety), ideally within 24 hours and no more than 3 days after the sighting. If practicable, carefully collect the dead specimen and preserve the material in the best possible state, contingent on the acquisition of any necessary wildlife permits and compliance with health and safety standards.

4.6 Survey Results and Data: The Lessee must provide the results of avian surveys and data to BOEM and USFWS with its plans.

5 Fishery Monitoring Conditions for Endangered and Threatened Species

5.1 The Lessee must ensure that all trap/pot/gillnet gear follow required best practices, including:

- All sampling gear will be hauled at least once every 30 days, and all gear will be removed from the water and stored on land between sampling season.

- No surface floating buoy lines will be used.
- All groundlines will be composed of sinking line.
- Buoy lines will use weak links (< 1,700-pound breaking strength).
- Gillnet strings will be anchored with a Danforth-style anchor with a minimum holding strength of 22 pounds.
- Knot-free buoy lines will be used to the extent practicable.

5.2 The Lessee must ensure that all trap/pot and gillnet gear used in fishery surveys is uniquely marked to distinguish it from other commercial or recreational gear. Marked gear must use yellow and black striped duct tape, placed along a 3-foot-long mark within 12 feet (3.66 meters) of a buoy. In addition, using black and white paint or duct tape, Lessee must place three additional marks on the top, middle, and bottom of the line. Any changes in marking must not be made without notification and concurrence from BOEM. BOEM will consult with the NMFS Greater Atlantic Regional Fisheries Office, Protected Resources Division concerning any requested changes as may be necessary.

5.3 The Lessee must ensure all gillnet sampling times are limited to no more than 24 hours to reduce mortality of entangled sea turtles and sturgeon. If weather or other safety concerns prevent retrieval of the gear within 24 hours of it being set, NMFS Greater Atlantic Regional Fisheries Office, Protected Resources Division (at nmfs.gar.incidental-take@noaa.gov) must be notified, and the gear must be retrieved as soon as it is safe to do so.

5.4 The Lessee must ensure that any survey gear lost is reported and recovered according to BOEM and BSEE Marine Debris Elimination and Reporting requirements. All lost gear must also be reported to NMFS Greater Atlantic Regional Fisheries Office, Protected Resources Division (at nmfs.gar.incidental-take@noaa.gov) within 24 hours of the documented time when gear is discovered to be missing or lost. This report must include information on any markings on the gear and any efforts undertaken or planned to recover the gear.

5.5 The Lessee must ensure all vessels have at least one survey team member onboard the trawl surveys and ventless trap surveys who has completed Northeast Fisheries Observer Program observer training (or another training in protected species identification and safe handling, inclusive of taking genetic samples from Atlantic sturgeon) within the last 5 years. Reference materials for identification, disentanglement, safe handling, and genetic sampling procedures must be available on board each survey vessel. This requirement is in place for any trips where gear is set or hauled. Documentation of training must be provided to BOEM and BSEE within 48 hours upon request.

5.6 The Lessee must ensure all vessels deploying fixed gear (e.g., gillnets, pots/traps) must have adequate disentanglement equipment (i.e., knife and boathook) onboard. Any disentanglement must occur consistent with the Northeast Atlantic Coast Sea Turtle Disentanglement Network Guidelines[4] and the procedures described in "Careful Release Protocols for Sea Turtle Release with Minimal Injury."[5]

[4] https://www.reginfo.gov/public/do/DownloadDocument?objectID=102486501

[5] https://repository.library.noaa.gov/view/noaa/3773

5.7 The Lessee must ensure any marine mammals, sea turtles, or Atlantic sturgeon caught and/or retrieved in any fisheries survey gear are identified to species or species group and reported to the Department of the Interior via email to BOEM (at renewable_reporting@boem.gov), BSEE (at Technical Information Management System [TIMS] Web Portal and notification email at protectedspecies@bsee.gov), and NMFS Greater Atlantic Regional Fisheries Office, Protected Resources Division (at nmfs.gar.incidental-take@noaa.gov). Each ESA-listed species caught and/or retrieved must then be properly documented using appropriate equipment and the NMFS data collection form.[6] Biological data, samples, and tagging must occur as outlined below:

5.7.1 The Lessee must follow the project design criteria and best management practices for observation, interaction, handling, and reporting of marine mammals listed in Appendix A of the NMFS BA (BOEM, 2023b).

5.7.2 The Lessee must follow the Sturgeon and Sea Turtle Take Standard Operating Procedures.[7]

5.7.3 The Lessee must equip survey vessels with a passive integrated transponder (PIT) tag reader onboard capable of reading 134.2 kilohertz and 125 kilohertz encrypted tags (e.g., Biomark GPR Plus Handheld PIT Tag Reader), and this reader must be used to scan any captured sea turtles and sturgeon for tags. Any recorded tags must be recorded on the take reporting form[8] and reported to the Department of the Interior via email to BOEM (at renewable_reporting@boem.gov), BSEE, (at TIMS Web Portal and notification email at protectedspecies@bsee.gov), and NMFS Greater Atlantic Regional Fisheries Office, Protected Resources Division (at nmfs.gar.incidental-take@noaa.gov).

5.7.4 The Lessee must take genetic samples from all captured Atlantic sturgeon (alive or dead) to allow for identification of the DPS of origin of captured individuals and the tracking of the amount of incidental take. This sample collection must be done in accordance with the Procedures for Obtaining Sturgeon Fin Clips.[9]

5.7.4.1 Fin clips must be sent to a BOEM approved laboratory capable of performing genetic analysis and assignment to DPS of origin. Results of genetic analysis, including assigned DPS of origin, must be submitted to the Department of the Interior via email to BOEM (at renewable_reporting@boem.gov), BSEE (at TIMS Web Portal and notification email at protectedspecies@bsee.gov) and NMFS Greater Atlantic Regional Fisheries Office, Protected Resources Division (at nmfs.gar.incidental-take@noaa.gov) within 6 months of the sample collection.

5.7.4.2 Subsamples of all fin clips and accompanying metadata form must be held and submitted to the Atlantic Coast Sturgeon Tissue Research Repository on a quarterly basis utilizing the Sturgeon Genetic Sample Submission Form.[10]

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[6] https://media.fisheries.noaa.gov/2021-07/Take%20Report%20Form%2007162021.pdf?null
[7] https://media.fisheries.noaa.gov/2021-11/Sturgeon-Sea-Turtle-Take-SOPs-external-11032021.pdf
[8] https://media.fisheries.noaa.gov/2021-07/Take%20Report%20Form%2007162021.pdf?null
[9] https://media.fisheries.noaa.gov/dam-migration/sturgeon_genetics_sampling_revised_june_2019.pdf
[10] https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-take-reporting-programmatics-greater-atlantic

5.7.5 The Lessee must ensure all captured sea turtles and Atlantic sturgeon are documented with required measurements, photographs, body condition, and descriptions of any marks or injuries. This information must be entered as part of the record for each capture. An NMFS Take Report Form[11] must be filled out for each individual sturgeon and sea turtle and submitted to the Department of the Interior via email to BOEM (at renewable_reporting@boem.gov), BSEE (at TIMS Web Portal and notification email at protectedspecies@bsee.gov), and NMFS Greater Atlantic Regional Fisheries Office, Protected Resources Division (at nmfs.gar.incidental-take@noaa.gov).

5.7.6 The Lessee must ensure any live, uninjured animals are returned to the water as quickly as possible after completing the required handling and documentation. Live and responsive sea turtles or Atlantic sturgeon caught and retrieved in gear used in any fisheries survey should be released according to established protocols and whenever at-sea conditions are safe for those releasing the animal(s). Any unresponsive sea turtles or Atlantic sturgeon caught and retrieved in gear used in fisheries surveys must be handled and resuscitated whenever at-sea conditions are safe for those handling and resuscitating the animal(s). Specifically:

5.7.6.1 To the extent allowed by sea conditions, the Lessee must give priority to the handling and resuscitation of any sea turtles or sturgeon that are captured in the gear being used. Handling times for these species should be minimized (i.e., kept to 15 minutes or less) to limit the amount of stress placed on the animals.

5.7.6.2 All survey vessels must have copies of the sea turtle handling and resuscitation requirements found at 50 CFR 223.206(d)(1) prior to the commencement of any on-water activity.[12] These handling and resuscitation procedures must be executed any time a sea turtle is incidentally captured and brought onboard a survey vessel.

5.7.6.3 For sea turtles that appear injured, sick, distressed, or dead (including stranded or entangled individuals), survey staff must immediately contact the Greater Atlantic Region Marine Animal Hotline at 866-755-6622 for further instructions and guidance on handling, retention, and/or disposal of the animal. If unable to contact the hotline (e.g., due to distance from shore or lack of ability to communicate via phone), USCG should be contacted via VHF marine radio on Channel 16. If required, hard-shelled sea turtles (i.e., non-leatherbacks) may be held on board for up to 24 hours, provided that conditions during holding are authorized by the NMFS Greater Atlantic Regional Fisheries Office, Protected Resources Division and safe handling practices are followed. If the hotline or an available veterinarian cannot be contacted and the injured animal cannot be taken to a rehabilitation center, activities that could further stress the animal must be stopped. When sea-to-shore contact with the hotline or an available veterinarian is not possible, the animal must be allowed to recover and be responsive before safely releasing it to the sea.

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[11] https://media.fisheries.noaa.gov/2021-07/Take%20Report%20Form%2007162021.pdf?null
[12] https://media.fisheries.noaa.gov/dam-migration/sea_turtle_handling_and_resuscitation_measures.pdf

5.7.6.4 Attempts must be made to resuscitate any Atlantic sturgeon that are unresponsive or comatose by providing a running source of water over the gills as described in the Sturgeon Resuscitation Guidelines.[13]

5.7.6.5 NMFS may authorize that dead sea turtles or Atlantic sturgeon be retained on board the survey vessel, provided that appropriate cold storage facilities are available on the survey vessel. Sea turtle and sturgeon carcasses should be held in cold storage (frozen is preferred, although refrigerated is permitted if a freezer is not available) until retention or disposal procedures are authorized by the NMFS Greater Atlantic Regional Fisheries Office, Protected Resources Division for transfer to an appropriately permitted partner or facility on shore.

5.7.7 The Lessee must notify the Department of the Interior via email to BOEM (at renewable_reporting@boem.gov), BSEE (at TIMS Web Portal and notification email at protectedspecies@bsee.gov), and NMFS Greater Atlantic Regional Fisheries Office, Protected Resources Division (at nmfs.gar.incidental-take@noaa.gov) within 24 hours of any interaction with a sea turtle or sturgeon and include the NMFS take reporting form.[14] The report must include at a minimum, the following: (1) survey name and applicable information (e.g., vessel name, station number); (2) Global Positioning System coordinates describing the location of the interaction (in decimal degrees); (3) gear type involved (e.g., bottom trawl, gillnet, longline); (4) soak time, gear configuration and any other pertinent gear information; (5) time and date of the interaction; (6) identification of the animal to the species level (if possible), and (7) a photograph or video of the animal (multiple photographs are suggested, including at least one photograph of the head scutes). If reporting within 24 hours is not possible (e.g., due to distance from shore or lack of ability to communicate via phone, fax, or email), reports must be submitted as soon as possible; late reports must be submitted with an explanation for the delay.

5.7.8 The Lessee must submit an annual report within 90 days of the completion of each survey season to BOEM (at renewable_reporting@boem.gov) and NMFS Greater Atlantic Regional Fisheries Office, Protected Resources Division (at nmfs.gar.incidental-take@noaa.gov). The report must include all information on any observations of and interactions with ESA-listed species and contain information on all survey activities that took place during the season, including location of gear set, duration of soak/trawl, and total effort. The report on survey activities must be comprehensive of all activities, regardless of whether ESA-listed species were observed.

[13] https://media.fisheries.noaa.gov/dam-migration-miss/Resuscitation-Cards-120513.pdf

[14] https://media.fisheries.noaa.gov/2021-07/Take%20Report%20Form%2007162021.pdf?null

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