

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

Final Environmental Assessment

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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 a 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 that would support a project not to exceed 10,000 acres (40.5 square kilometers) and would site the lease in a location that minimizes impacts on conflicting uses. **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

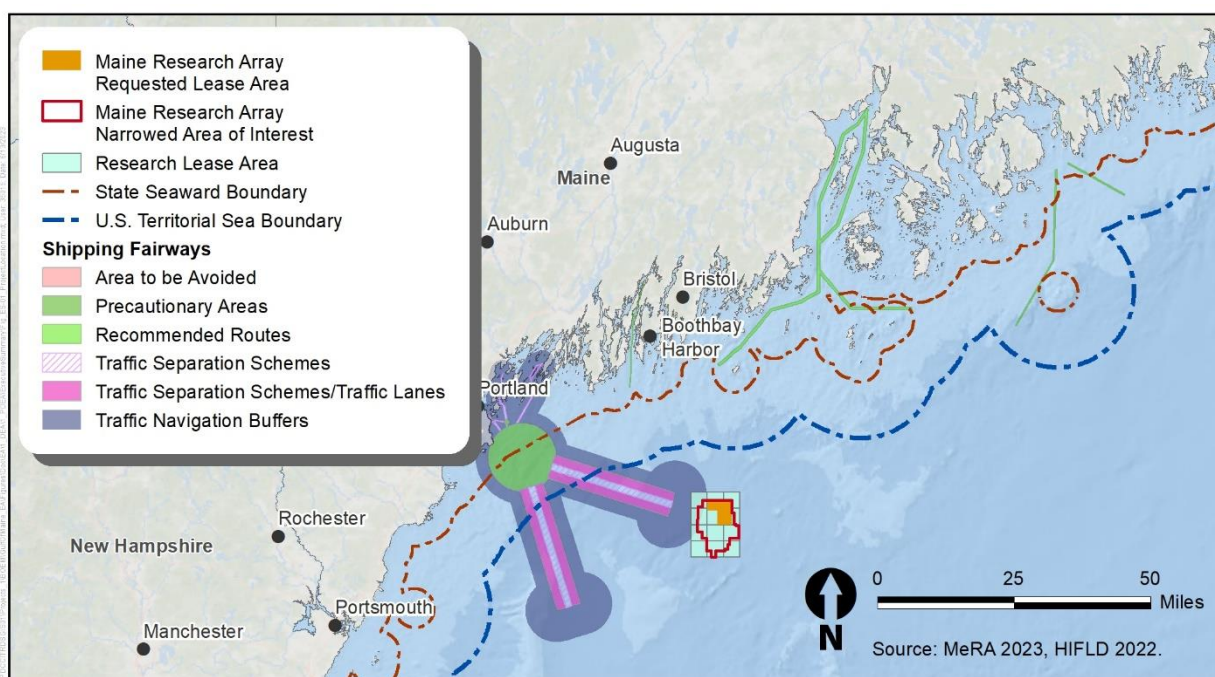


Figure ES-1. Location of Research Lease Area

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
DMR	Maine Department of Marine Resources
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
PM ₁₀	particulate matter with a diameter less than or equal to 10 micrometers
PM _{2.5}	particulate matter with a diameter less than or equal to 2.5 micrometers
PSO	protected species observer
PTOW	Pine Tree Offshore Wind
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 (i.e., the lessee) 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 <i>Federal Register</i> for a 45-day public comment period (87 <i>Federal Register</i> 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 <i>Federal Register</i> (88 <i>Federal Register</i> 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 <i>Federal Register</i> for a 30-day public comment period that closed on June 5, 2023 (88 <i>Federal Register</i> 28611). Public comments received were considered in the preparation of the Draft EA.
July 21, 2023	BOEM published a Notice of Availability for the Draft EA in the <i>Federal Register</i> with a 30-day public comment period that closed on August 21, 2023 (88 <i>Federal Register</i> 47172). BOEM revised this EA to address comments received during the comment period and incorporate the results of consultations.

CFR = Code of Federal Regulations; DNCI = Determination of No Competitive Interest; km = kilometer; km² = 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 E**. 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 4, 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.

Reference	Relevance
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.
BOEM. 2023g. Wind energy research lease on the Atlantic Outer Continental Shelf offshore Maine 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 under NMFS jurisdiction during data collection and site survey activities for renewable energy on the Atlantic OCS.
BOEM. 2023i. Wind energy research lease on the Atlantic Outer Continental Shelf offshore Maine essential fish habitat assessment for the National Marine Fisheries Service.	Evaluates potential effects of the site assessment and characterization activities on EFH and EFH species under the jurisdiction of NMFS.
BOEM. 2023h. Wind energy research lease on the Atlantic Outer Continental Shelf offshore Maine biological assessment for the United States Fish and Wildlife Service.	Evaluates potential effects of the site assessment and characterization activities on ESA-listed species under USFWS jurisdiction.
BOEM. 2022b. 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. 2022a. 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; EFH = essential fish habitat; ESA = Endangered Species Act; PDC = project design criterion

1.4 Changes Made Since the Draft EA

The Final EA incorporates various changes made due to the emergence of new information or in response to comments on the Draft EA and subsequent reviews of the administrative Final EA by BOEM staff and cooperating agencies. The most notable changes are listed below.

- Removal of gillnet surveys from the Proposed Action due to the potential for adverse impacts on Endangered Species Act (ESA)-listed species.
- Updates to the number of estimated vessel trips and associated emissions for site assessment and site characterization activities, as detailed in Appendices A and B, based on the change above and updates to the anticipated schedule for conducting the activities.
- Incorporation of a new proposed mitigation measure in Appendix D requiring the lessee to ensure trawl surveys would not be carried out in water depths shallower than 197 feet (60 meters) to minimize the potential for interaction with Atlantic sturgeon.
- Inclusion of a new appendix, Appendix F, which summarizes and responds to public comments received during the two public comment periods for the EA.
- Revision or expansion of information and citations used to characterize the affected environment and additional quantification of the extent of anticipated impacts on benthic habitat in response to comments received from NMFS.

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 [km²]) 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 that would support a project not to exceed 10,000 acres (40.5 km²) and would site the lease in a location within the Research Lease Area that minimizes impacts on conflicting uses. **Figure 2-1** also shows the State of Maine's narrowed area of interest (34,596 acres [140 km²]) and requested lease area (9,728 acres [39.4 km²]) 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. The Proposed Action would also result in site characterization activities, which 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) Regional General Permit, BOEM and BSEE's responsibilities under the Outer Continental Shelf Lands Act (43 U.S. Code 1331 et seq.) are limited to ensuring consistency with requirements from ESA consultations with NMFS and USFWS and related requirements under the Marine Mammal Protection

Act. 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.

The research lease would be issued to the State of Maine, which is uniquely qualified to hold the research lease pursuant to 30 CFR 585.239(a). The State of Maine would coordinate and oversee the performance of site assessment and site characterization activities conducted by the Maine Department of Marine Resources (DMR) and Pine Tree Offshore Wind (PTOW), as indicated in **Table 2-2**. PTOW—a partnership between Diamond Offshore Wind and RWE Renewables—would be the designated operator of the potential future Research Array.

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.

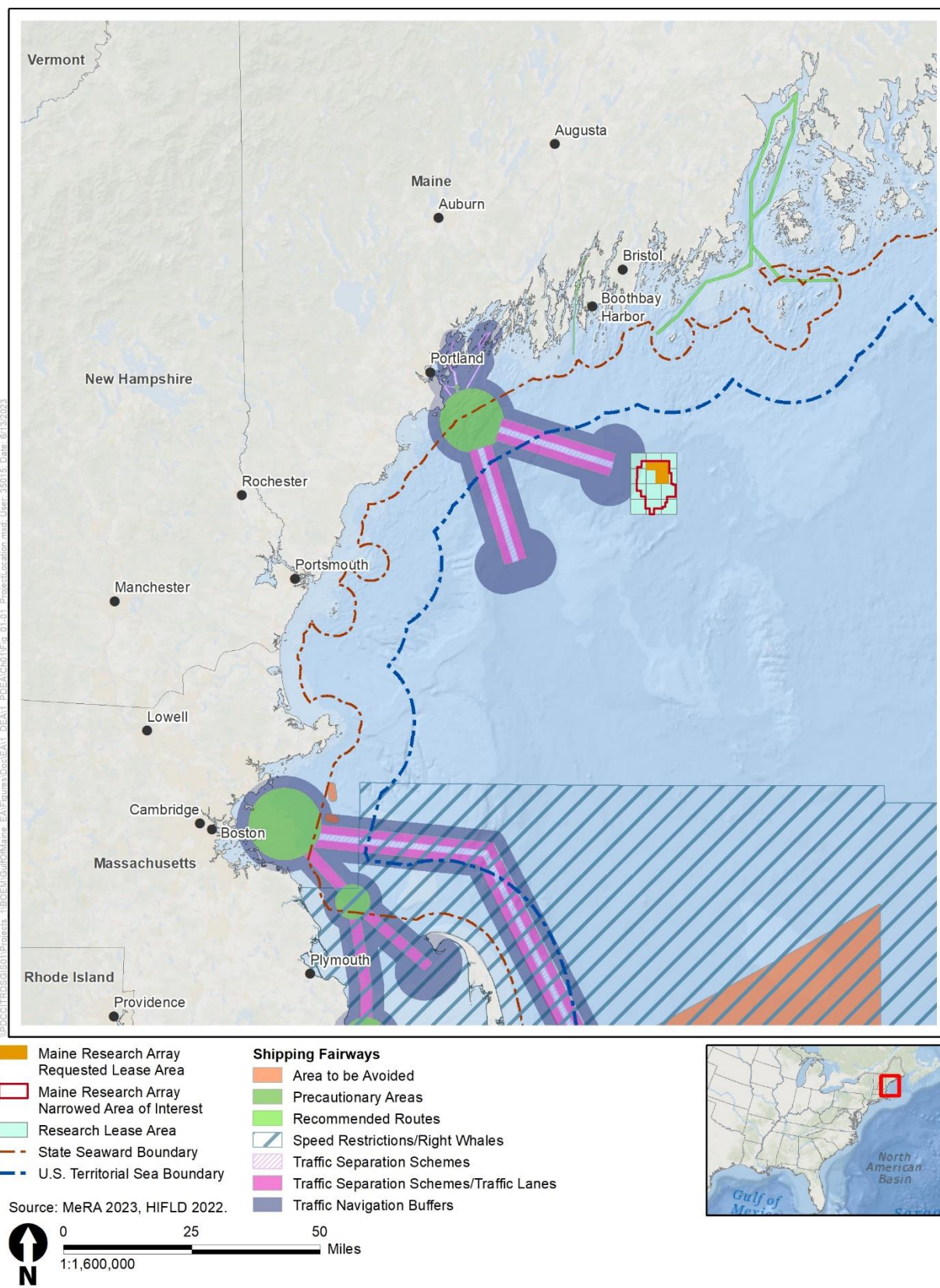


Figure 2-1. Location of Research Lease Area

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 (Quarter 2 2024 through Quarter 2 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 through November 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.	Hull-mounted multibeam echosounder with backscatter measurement (proxy for seafloor hardness) and a parametric sub-bottom profiler (Innomar SES-2000 Medium-100) 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. There would be no towed equipment.
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 through May 2025.	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 (for future floating wind turbine foundations) 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 through May 2025 and August through November 2025.	Portland, ME	24-hour vessel, with a length of approximately 246–262 feet (75–80 meters).	Shallow geotechnical coring (piston or vibracores) to depths of approximately 6–12 inches (15–30 centimeters) and cone penetration testing to depths up to approximately 82 feet (25 meters). 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 with each sample disturbing several square meters of the seafloor. The survey vessel may be equipped with a moon pool—an opening at the base of the vessel hull that provides crew with access to the water below.

Survey or Monitoring Activity	Description	Activity Frequency and Timing	Port	Vessel Type	Equipment or Method
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 Research Lease 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 reconnaissance G&G surveys. September 2024 through November 2024.	Portland, ME	See geophysical reconnaissance and G&G surveys.	Benthic grabs (Young-modified Van Veen grab sampler), and frame-mounted sediment profile imaging/plan view cameras. 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. The typical seabed disturbance is less than 6.6 ft ² (2 m ²) for each grab site, including the direct impact from the sampling frame. Grab samples would be processed using the Maine Coastal Mapping Initiative's existing protocols.

Survey or Monitoring Activity	Description	Activity Frequency and Timing	Port	Vessel Type	Equipment or Method
Seafloor Habitat Characterization Surveys	DMR would conduct 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.	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.	Multibeam sonar surveys with underwater video.

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.	Installation of radar stations began in 2023. Test glider deployments to work out logistics began in July 2023. Data-collecting glider deployments beginning in July 2024 and continuing until approval of the RAP. ⁴ Monitoring from shore-based radar stations would occur continuously. Glider deployments would occur every other month 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 Slocum glider with a length of 5 feet (1.5 meters) and a hull diameter of 8.7 inches (22 centimeters). The average speed of the glider is 1.2 mph (1.9 kph or 1 knot) and thruster speed is up to 2.3 mph (3.7 kph or 2 knots). The glider measures the parameters of the water in-situ and does not collect samples.

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.	Four flights conducted quarterly, May 2023 through March 2024. Thereafter monthly, April 2024 through March 2025, with possible extension through March 2026.	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 Research Lease Area, but may be reduced to cover the requested research lease, if issued, 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. Test surveys to work out logistics began in Quarter 4 of 2022. Data-collection surveys beginning in April 2024 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 within and up to 12 nm (22 km) outside of the Research Lease Area 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 June 2024 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. The anchor for each monitoring unit consists of a 4-foot (1.2-meter) long steel beam that remains stationary on the seafloor.

Survey or Monitoring Activity	Description	Activity Frequency and Timing	Port	Vessel Type	Equipment or Method
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. Project would also fund the deployment of up to two new Motus receivers on coastal islands. Funding would also be contributed toward tagging of birds by others (e.g., university researchers).	Expected to require 2 trips, conducted as part of FLiDAR buoy deployment and decommissioning. 24-month deployment (Quarter 2 2024 through Quarter 2 2026). Deployment of additional Motus receivers and bird tagging would follow the same schedule as above.	Portland, ME	See FLiDAR buoy-based acoustic monitoring.	Motus Wildlife Tracking System-compatible receiver stations.
Active Acoustic Surveys and Environmental DNA (eDNA) Sampling of Marine Fish and Invertebrates	Under contract to DMR, the 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.	Two 12-hour vessel trips per month, every other month. Test surveys to work out logistics began in Quarter 4 of 2022. Data-collection surveys beginning in April 2024 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.

Survey or Monitoring Activity	Description	Activity Frequency and Timing	Port	Vessel Type	Equipment or Method
Passive Acoustic Monitoring of Large Pelagic and Benthic Fish	DMR opportunistically tags fish with passive acoustic tags via rod and reel fishing 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. Receivers would be deployed continuously beginning in June 2024 and tagging 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 on a Spectra rope line 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 (a total of 120–150 tows annually). The survey area ranges in depth from approximately 269–610 feet (82–186 meters). 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 in Quarter 4 of 2024 and continuing 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) for approximately 20 minutes.

Survey or Monitoring Activity	Description	Activity Frequency and Timing	Port	Vessel Type	Equipment or Method
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. Plankton surveys would be conducted monthly year-round, while Neuston sources would be conducted monthly from April through November. Test surveys to work out logistics began in Quarter 4 of 2023. Data-collection surveys beginning in April 2024 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. Each Neuston tow would be conducted with a 1-foot (0.3-meter) wide net for approximately 15 minutes and would follow DMR's larval survey protocol. Plankton nets do not have a set time in the water but would be retrieved with a pot hauler within 2–3 minutes. 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 Trap Surveys	DMR would conduct lobster trap surveys to characterize the lobster population, including the presence of large egg-bearing and oversized lobsters, and to assess movement patterns of lobsters. Traps would be set within and up to 12 nm (22 km) outside the Research Lease Area and hauled three times per quarter with targeted weeklong soaks. Surveys would not be conducted under regular commercial fishing.	Six trips by 12-hour vessel per quarter. Beginning as soon as September 2024 and continuing until approval of the RAP. ⁴	Bristol, ME	50-foot (15-meter) commercial lobster boat, single screw.	Twenty-five survey strings would be equipped with 12 traps tied together (300 total traps), including vented and ventless trap types, and would be set with one ropeless fishing unit. All gear will follow the requirements of the commercial Atlantic Large Whale Take Reduction Plan rules, including use of sinking groundline. The exact gear specifications and line diameter would be determined based on conversations with industry members. The traps would be removed as soon as the three hauls were completed and stored on land.

Sources: DMR, 2023a; Stantec, 2023. Information was refined and updated based on continued coordination with DMR and PTOW.

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 manned vessels would have trained observers onboard to monitor for impacts on marine mammals and wildlife. Unmanned surface vessels, if used, would have trained observers onshore, monitoring cameras and sensors on the unmanned surface vessels.

³ 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 figdeck 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 February 2029.

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.

FLiDAR = floating light detection and ranging; ft² = square foot; kg = kilogram; kHz = kilohertz; km = kilometer; kph = kilometers per hour; m² = square meter; MA = Massachusetts, ME = Maine; mph = miles per hour; nm = nautical mile

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 Regional General 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
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 trap 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 would support a project that will neither exceed 10,000 acres (40 km²) 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. 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. 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. Other equipment that may be deployed to recover lost equipment includes 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 to BSEE within 24 hours of the documented time when gear is discovered to be missing or lost 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 (**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, 2023g). Selection of a recovery method and mitigation strategy would depend on the nature of the lost equipment, and further consultation may be necessary depending on the potential for impacts from the recovery operations.

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.

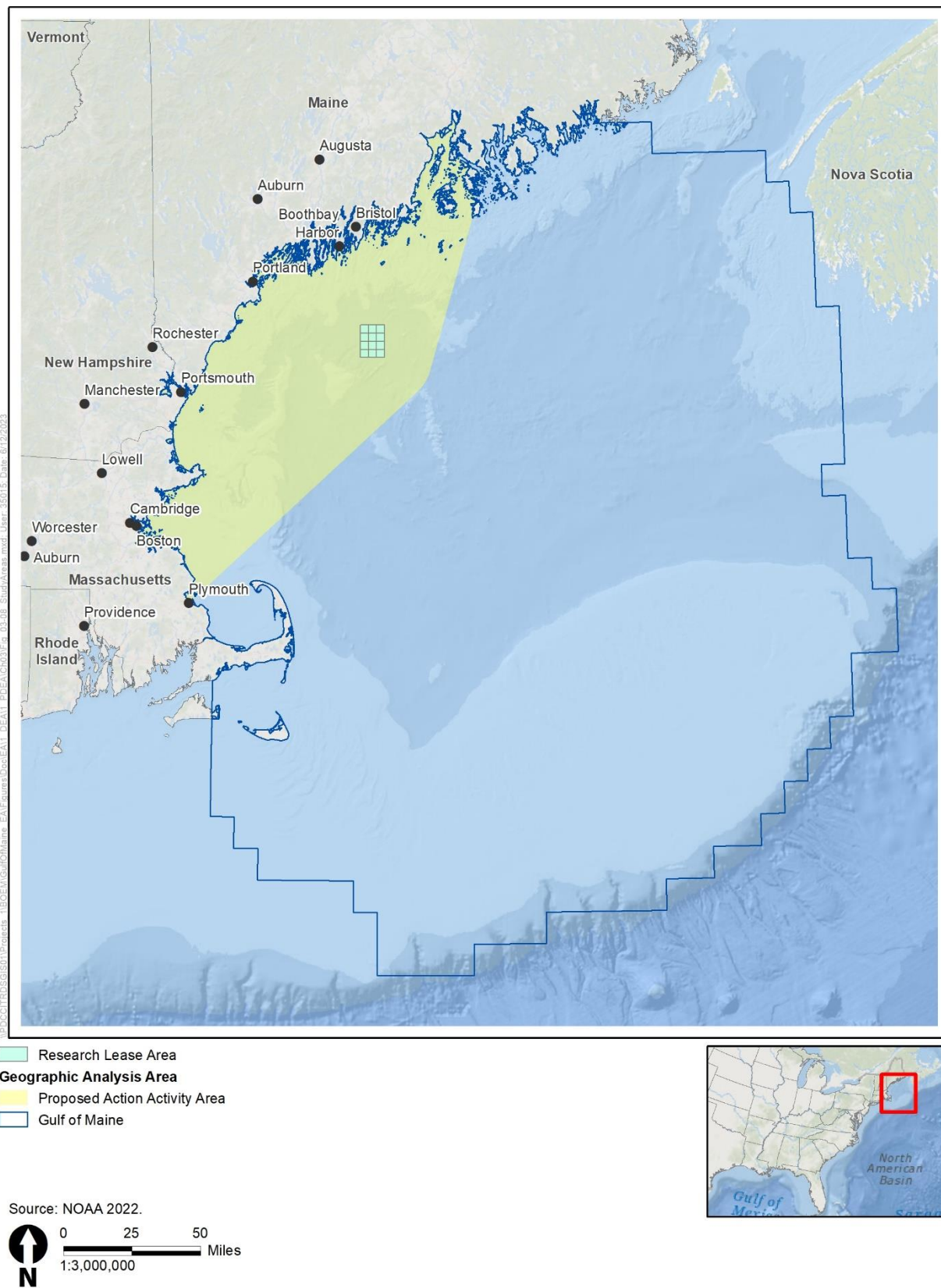


Figure 3-1. Geographic analysis areas

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 area will account for their highly mobile nature when utilizing habitat in the vicinity of the Research Lease Area and other areas of survey activity, including 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, including 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. There are no records of northern long-eared bats on the OCS, and the available bat survey data suggest there is little evidence of use of the offshore environment (Dowling et al., 2017; Hatch et al., 2013; Pelletier et al., 2013; Sjollema et al., 2014; Smith and McWilliams, 2016). 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. The USFWS BA prepared in association with this EA provides additional evaluation of potential impacts on bat species (BOEM, 2023h).
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. The USFWS BA prepared in association with this EA provides additional evaluation of potential impacts on bird species (BOEM, 2023h).

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 (SO₂), nitrogen dioxide

(NO₂), carbon monoxide (CO), ozone (O₃), particulate matter (PM₁₀ and PM_{2.5}, particulate matter with a diameter less than or equal to 10 and 2.5 micrometers, respectively), and lead. O₃ 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 km²) assessed that are designated for shellfish harvest, 99.5 percent of 2,889 square miles (7,482 km²) 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. The nearest distance from the Maine shoreline to the Research Lease Area boundary is 19 nautical miles (nm) (35.2 km). From tidal areas to roughly 9 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 (Fountain et al., 2019). 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). According to the coral map portal, the Gorgonian corals and unspecified sponges are known to be landward of the Research Lease Area (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 km²) 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 Gulf of Maine (Stevenson et al., 2014).

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 (Collette and Klein-MacPhee, 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).

The Magnuson-Stevens Fishery Conservation and Management Act was enacted in 1976 and set in place multiple mandates related to the collection of science-based fisheries data, fisheries management, and conservation of aquatic resources for the preservation of commercial and recreational fisheries resources. The Magnuson-Stevens Fishery Conservation and Management Act requires federal agencies to consult with the Secretary of Commerce, through NMFS, with respect to "any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken, by such agency that may adversely affect any essential fish habitat" (16 U.S. Code 1855(b)(2)). This process is guided by the requirements of the essential fish habitat (EFH) regulation at 50 CFR 600.905.

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

The EFH regulations define an adverse effect as "any impact which reduces the quality and/or quantity of EFH" (50 CFR 600.810(a)). The regulations further state: "Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat and other ecosystems components, if such modifications reduce the quality and/or quantity of EFH." The EFH final rule also states that the loss of prey may have an adverse effect on EFH and managed species. As a result, actions that reduce the availability of prey species, either through direct harm or capture or through adverse impacts on the

prey species' habitat, may also be considered adverse effects on EFH. Adverse effects on EFH may result from actions occurring within EFH or outside EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.

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, 2023i).

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 Atlantic bluefin tuna (*Thunnus thynnus*), Bigeye tuna (*Thunnus obesus*), and sharks including basking shark (*Cetorhinus maximus*), blue shark (*Prionace glauca*), common thresher (*Alopias vulpinus*), and porbeagle (*Lamna nasus*). Habitat areas of particular concern (HAPCs) 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, such as eelgrass. The Jeffrey's Ledge/Stellwagen Bank HAPC is within the Stellwagen Bank National Marine Sanctuary. The Jeffrey's Ledge/Stellwagen Bank HAPC is a diverse marine habitat formed during glacial geomorphological forming processes and includes gravel/cobble substrates, boulder reefs, sand plains, and deep mud basins (NEMFC, 2017). This dual HAPC is an important habitat and fishing ground for Atlantic cod (EFH managed species), haddock (EFH managed species), pollock (EFH managed species), cusk, hake (Red and Silver hake EFH), flounders (summer, winter, windowpane, and witch flounder), herring (Atlantic herring EFH), and Atlantic mackerel (EFH managed species [NEFMC, 2017]). The NOAA-designated HAPC for inshore juvenile Atlantic cod extends throughout the GAA (**Figure 3-2**) along the coasts of Maine, New Hampshire, and Massachusetts, extending from the shoreline to 66 feet (20 meters). Juvenile cod habitat is defined as structurally complex benthic habitat, such as eelgrass beds, algae, rocky benthic habitat, and contiguous sandy habitats that support a diverse emergent epifauna and benthic invertebrates assemblage (NEFMC, 2017). HAPCs for summer flounder include native species of macroalgae, seagrasses (eelgrass), 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 overlaps a narrow segment of the western edge of Jeffrey's Bank and is contiguous with the western boundary of the Ground Fish Closure Areas. 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). Fish and invertebrates 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).

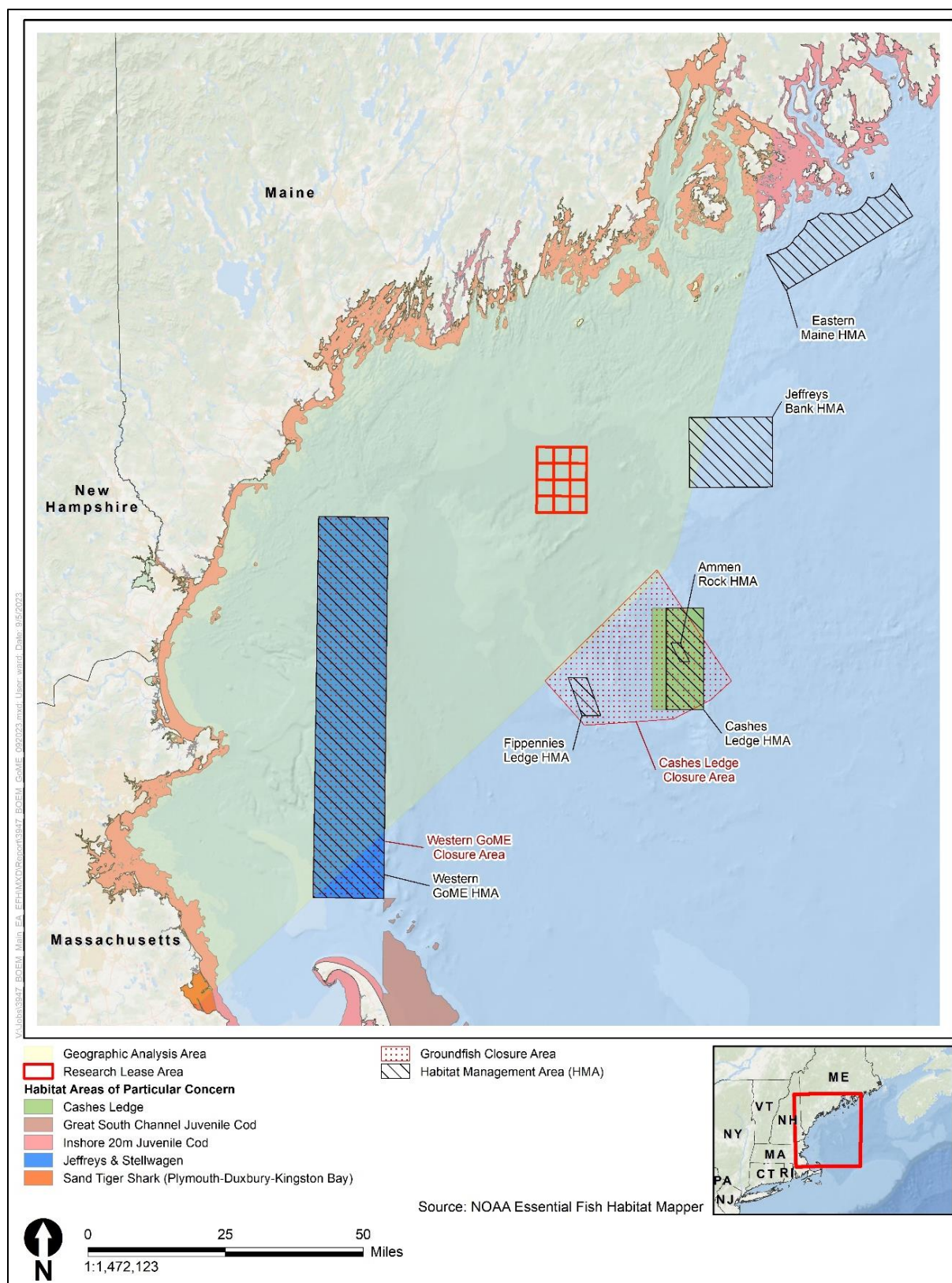


Figure 3-2. Habitat areas of particular concern in the vicinity of the Research Lease Area within the Gulf of Maine

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	<i>Balaenoptera musculus</i>	E/D	Rare	Rare	N/A	Western North Atlantic	402 ⁷	Unknown	Unknown	Hayes et al. (2020)
Fin whale	<i>Balaenoptera physalus</i>	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	<i>Megaptera novaeangliae</i>	None/N	Common	Year-round (highest abundances mid-spring through fall)	N/A	Gulf of Maine	1,396	+2.8% <u>per year</u> (2000 through 2016)	12.15	Hayes et al. (2020)
Minke whale	<i>Balaenoptera acutorostrata</i>	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	<i>Eubalaena glacialis</i>	E/D	Common	Year-round (highest abundances late fall through spring)	Yes ⁸	Western North Atlantic	338	-29.7% <u>overall</u> (2011 through 2020)	8.1	Hayes et al. (2023)
Sei whale	<i>Balaenoptera borealis</i>	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	<i>Stenella frontalis</i>	None/N	Rare	Rare	N/A	Western North Atlantic	39,921	Decreasing	Presumed 0	Hayes et al. (2022)
Atlantic white-sided dolphin	<i>Lagenorhynchus acutus</i>	None/N	Common	Year-round	N/A	Western North Atlantic	93,233	Unknown	27.2	Hayes et al. (2022)
Blainville's beaked whale	<i>Mesoplodon densirostris</i>	None/N	Rare	Rare	N/A	Western North Atlantic	10,107 ⁹	Unknown	0.2	Hayes et al. (2020)
Common bottlenose dolphin (offshore)	<i>Tursiops truncatus</i>	None/N	Uncommon	Summer	N/A	Western North Atlantic, Offshore	62,851	Unknown	28	Hayes et al. (2020)
Common dolphin	<i>Delphinus delphis</i>	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	<i>Ziphius cavirostris</i>	None/N	Rare	Rare	N/A	Western North Atlantic	5,744	Unknown	0.2	Hayes et al. (2020)
Dwarf sperm whale	<i>Kogia sima</i>	None/N	Rare	Rare	N/A	Western North Atlantic	7,750 ¹⁰	Unknown	Presumed 0	Hayes et al. (2020)
Gervais' beaked whale	<i>Mesoplodon europaeus</i>	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	<i>Phocoena phocoena</i>	None/N	Common	Year-round	N/A	Gulf of Maine, Bay of Fundy	95,543	Unknown	163	Hayes et al. (2022)
Killer whale	<i>Orcinus orca</i>	None/N	Rare	Rare	N/A	Western North Atlantic	Unknown	Unknown	Unknown	Waring et al. (2015)
Long-finned pilot whale	<i>Globicephala melas</i>	None/N	Regular	Late spring through fall	N/A	Western North Atlantic	39,215	Unknown	9	Hayes et al. (2022)
Northern bottlenose whale	<i>Hyperodon ampullatus</i>	None/N	Rare	Rare	N/A	Western North Atlantic	Unknown	Unknown	Presumed 0	Waring et al. (2015)
Pygmy sperm whale	<i>Kogia breviceps</i>	None/N	Rare	Rare	N/A	Western North Atlantic	7,750 ¹⁰	Unknown	Presumed 0	Hayes et al. (2020)
Risso's dolphin	<i>Grampus griseus</i>	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	<i>Globicephala macrorhynchus</i>	None/N	Rare	Rare	N/A	Western North Atlantic	28,924	Unknown	136	Hayes et al. (2022)
Sowerby's beaked whale	<i>Mesoplodon bidens</i>	None/N	Rare	Rare	N/A	Western North Atlantic	10,107 ⁹	Unknown	0	Hayes et al. (2020)
Sperm whale	<i>Physeter macrocephalus</i>	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	<i>Stenella coeruleoalba</i>	None/N	Rare	Rare	N/A	Western North Atlantic	67,036	Unknown	0	Hayes et al. (2020)
True's beaked whale	<i>Mesoplodon mirus</i>	None/N	Rare	Rare	N/A	Western North Atlantic	10,107 ⁹	Unknown	0.2	Hayes et al. (2020)
White-beaked dolphin	<i>Lagenorhynchus albirostris</i>	None/N	Rare	Rare	N/A	Western North Atlantic	536,016	Unknown	0	Hayes et al. (2020)
Pinnipeds										
Gray seal	<i>Halichoerus grypus</i>	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	<i>Phoca vitulina</i>	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	<i>Pagophilus groenlandicus</i>	None/N	Uncommon	Late winter, early spring	N/A	Western North Atlantic	Unknown ¹¹	Increasing	178,573	Hayes et al. (2022)
Hooded seal	<i>Cystophora cristata</i>	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 potential biological removal 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 truncatus*; 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 *U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessment Report 2022* (Hayes et al., 2023) 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, 50 humpback whales have stranded in Maine, New Hampshire, and Massachusetts, with 208 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 158 individuals stranded from Maine to South Carolina, with 96 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 492 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 115 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, 34 live free-swimming whales with serious injuries due to entanglement or vessel strike, and 45 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). During the 2023 calving season (defined as calves born between mid-November 2022 and mid-April 2023), 12 calves were observed (down from 15 during the 2022 season and 20 during the 2021) (NMFS, 2023f). However, births remain significantly below what is expected, and the species continues to be in decline (Pace, 2021; Pettis et al., 2021, 2022). Data indicate a 29.7 percent decline in annual abundance since 2011 (NMFS, 2023f). The total annual average observed human-caused mortality and serious injury for the NARW is 8.1 individuals per year, averaged over the period between 2016 and 2020, although this likely represents an underestimate as not all mortalities are recorded (Hayes et al., 2023). Modeling using the 2015 to 2019 estimated annual means to account for undetected mortality and serious injury suggests the mortality rate could be as high as 31.2 animals per year (Hayes et al., 2023). Importantly, NARW mortalities exceed the species' calculated potential biological removal (0.7 individual per year). When coupled with the species' low fecundity and small

population size, all human-caused mortalities have the potential to affect their population status. The current population estimate for NARWs is at its lowest point in nearly 20 years, with a best-estimated 338 individuals remaining (Hayes et al., 2023; Pettis et al., 2022). Additional information about the current population status for NARWs is provided in the most recent stock assessment report (Hayes et al., 2023). The species' high mortality rate is driven primarily by fishing gear entanglement and vessel strike (Hayes et al., 2023). 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 (Hayes et al., 2023). Many marine mammal migrations cover long distances, and these factors can have impacts on individuals over broad geographical scales.

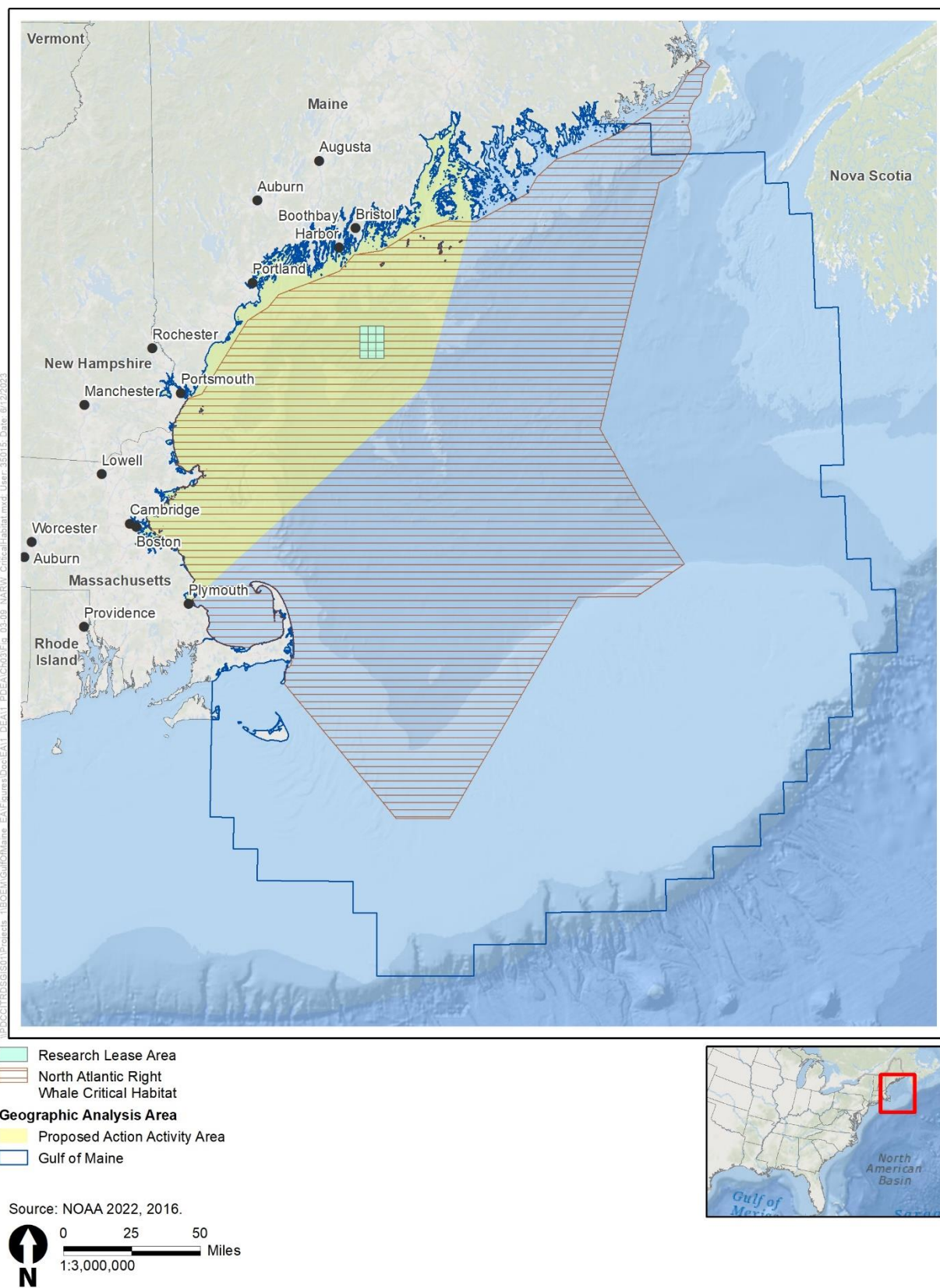


Figure 3-3. North Atlantic right whale northeastern critical habitat within the Gulf of Maine

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 et al., 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	<i>Chelonia mydas</i>	North Atlantic	Threatened	Uncommon	Summer through Fall
Kemp’s ridley sea turtle	<i>Lepidochelys kempii</i>	--	Endangered	Regular	Summer through Fall
Leatherback sea turtle	<i>Dermochelys coriacea</i>	Northwest Atlantic	Endangered	Regular	Summer through Fall
Loggerhead sea turtle	<i>Caretta caretta</i>	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 (2023h), stranding data (NMFS, 2023g), 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, 2023h). 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, 2023g). 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, 2023g). 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, 2023g). 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, 2023g).

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 Arleigh Burke-class destroyer 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.

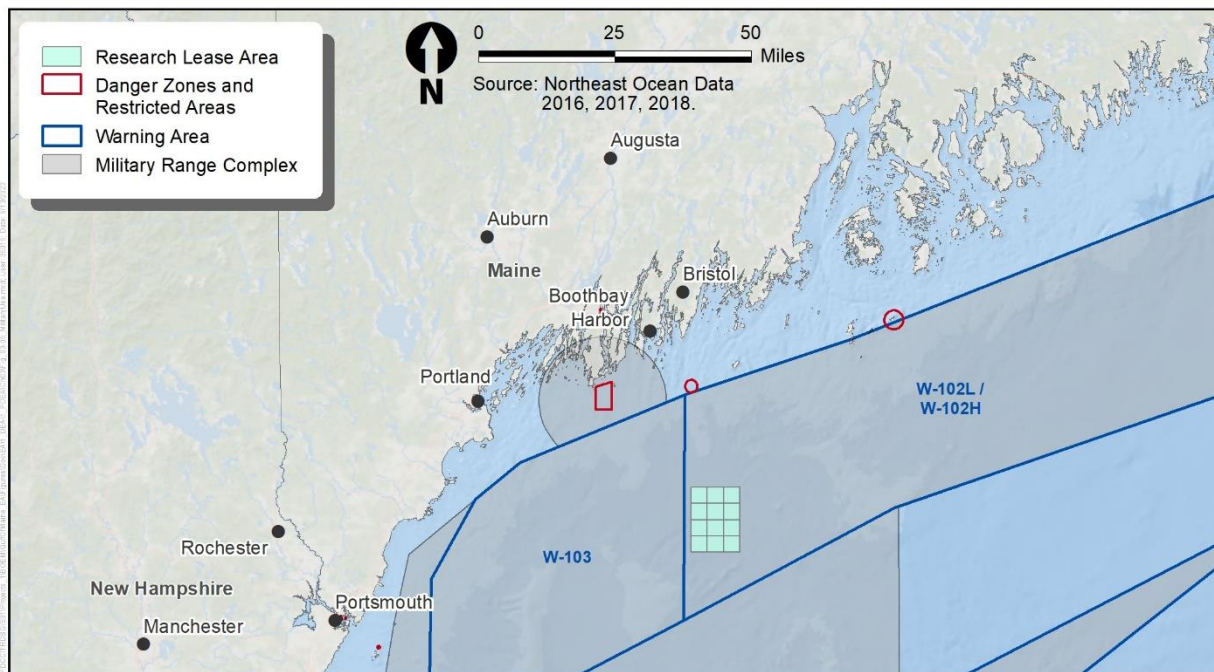


Figure 3-4. Military use areas in the vicinity of the Research Lease Area within the Gulf of Maine

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.

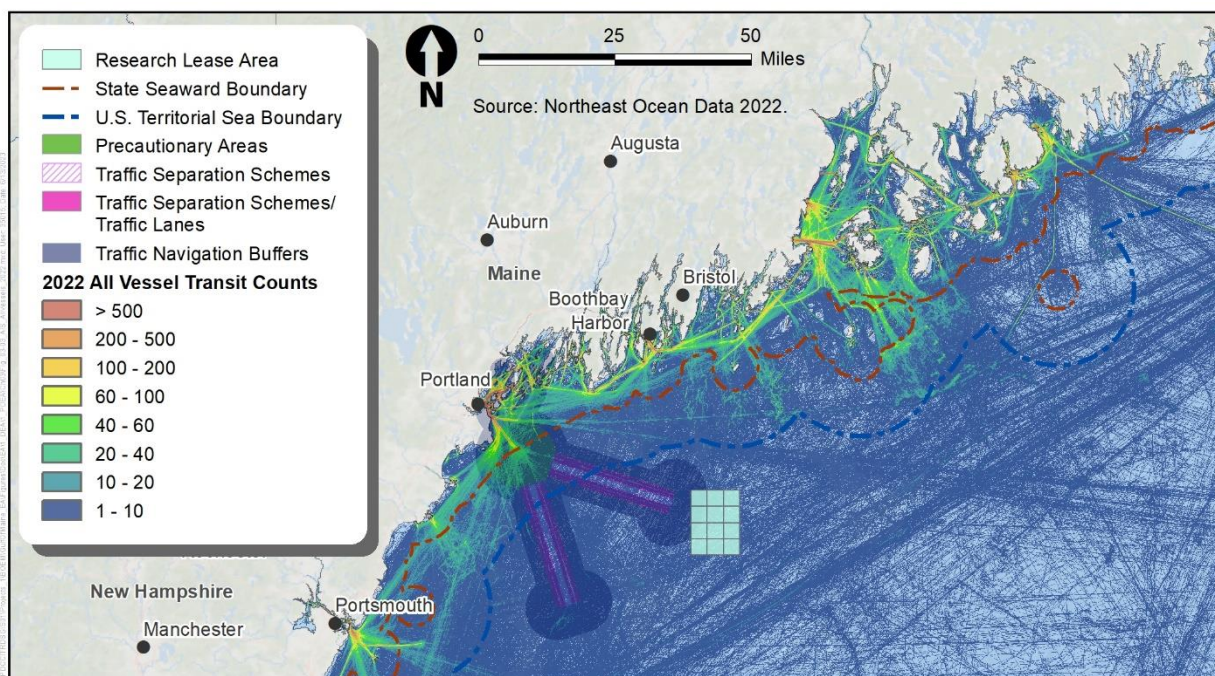


Figure 3-5. Automatic Identification System vessel track lines, 2022

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

Vessel Type	Vessel Track Counts				Unique Vessel Counts			
	2019	2020	2021	Average	2019	2020	2021	Average
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**).

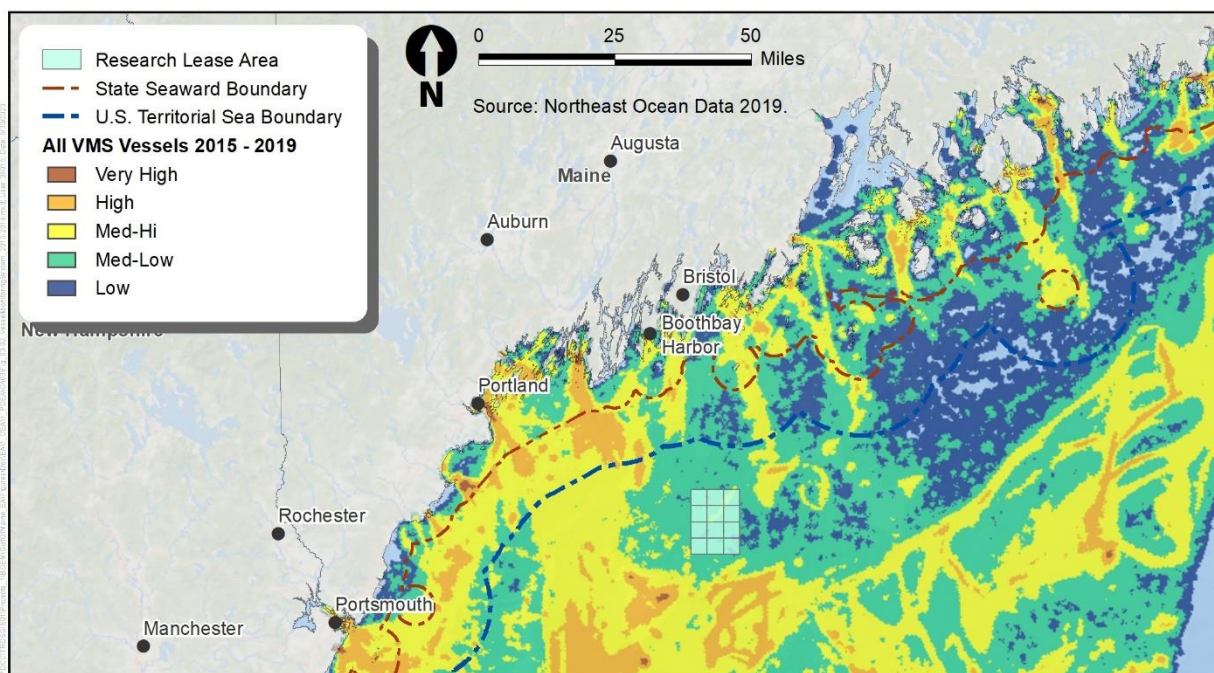


Figure 3-6. Vessel Monitoring System data for all fisheries, 2015–2019

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			
Bluefin tuna				X
Haddock	X			
Herring	X		X	
Mahogany quahog		X		
Monkfish	X	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
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
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, 2023i).

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
Knox	70.9
Lincoln	71.3
Waldo	65.9
Washington	44.7
York	46.9
New Hampshire	41.9
Rockingham	80

County/State	Percentage of Ocean-Related Economy Recreation and Tourism Jobs
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; NYSDA, 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.

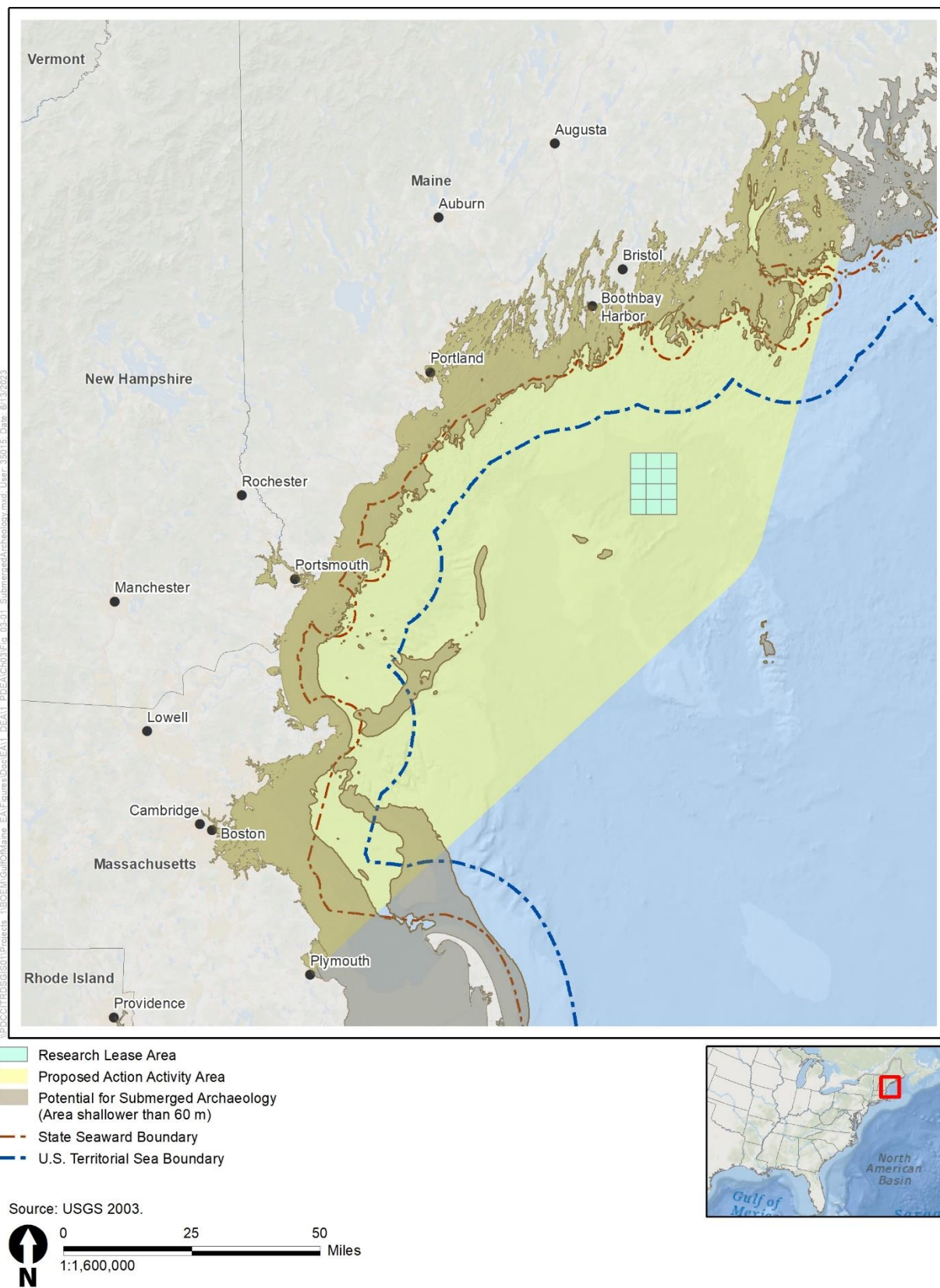


Figure 3-7. Areas with potential for submerged pre-Contact era archaeological sites

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 thresholds² for the counties closest to the Research Lease Area are as follows:

- 100 tons/year of NO_x (O₃ precursor)
- 50 tons/year of VOCs (O₃ precursor)
- 100 tons/year of CO
- 100 tons/year of PM
- 100 tons/year of SO₂

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.

² 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 Maine General Permit Numbers 13, 17, and/or 18, 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 trawl and lobster trap 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 (ft²) (3 square meters [m²]), 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. The single buoy would be installed at least 22 nm (40.7 km) from the shore. 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 and site characterization activities for the Proposed Action are detailed in **Table 2-1**. Geophysical 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), and therefore would not affect these taxa. For the sources that are audible, it is important to consider other factors such as source level, beamwidth, and duty cycle (Ruppel et al., 2022). Boomers, sparkers, hull-mounted sub-bottom profilers, and bubble guns have source levels close to the threshold for injury for invertebrates, so unless an individual 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 assuming a sound pressure level (SPL) threshold of 150 decibels (dB) referenced to 1 micropascal (re 1 μ Pa) for behavioral disturbance (Greater Atlantic Regional Fisheries Office, 2020). Although most literature focuses on seismic airgun surveys, which have much higher source levels than the HRG sources proposed here, the conclusions of these studies indicate that low-frequency noise does affect the behaviors of invertebrate species (Murchy et al., 2020; Wang et al., 2022; Weilgart, 2018). However, 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. Lack of evidence for any source due to extreme difficulty of measuring particle motion and determining fishes' sensitivity to particle motion renders establishment of any guidelines or thresholds for particle motion exposure currently impossible (Popper and Hawkins, 2018; Popper et al., 2014). However, particle motion is expected to be dominant only within short ranges (i.e., within 33 feet [10 meters]) around the source (Harding and Cousins, 2022; Mickle and Higgs,

2022), outside of which sound pressure effects would dominate. It is therefore expected that behavioral impact ranges would be even smaller for particle motion-sensitive species, including invertebrates, as particle motion would dominate the sound field within only a few meters from the source. Therefore, based on the available information, the planned HRG surveys could affect the behavior of benthic species, but impacts would be short term due to the intermittent nature of these sources and the relatively short duration of these surveys, and no population-level effects are anticipated.

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 these studies indicate there is 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.

Site assessment surveys also include geotechnical and benthic sampling as well as seafloor habitat characterization sampling and surveys (detailed in **Table 2-1**). Although specific numbers of required samples are not yet determined, conservative values of 300 cores and 600 grabs are used to estimate benthic disturbance footprint. The 1.1-ft² (0.1-m²) footprint for the Smith McIntyre benthic grab, for example, would only affect 645 ft² (60 m²), assuming 600 grabs were taken. Assuming 300 vibracores, each with a diameter of 3 inches (7.62 centimeters), would affect 16 ft² (1.5 m²) of the seafloor. Combined, less than 667 ft² (62 m²) of the seafloor would be disturbed from these sampling activities. To put this in perspective to the 68,320 acres (276 km²) of the Research Lease Area, the 0.2 acre (809 m²) of benthic habitat expected to be disturbed by sampling would be less than 0.000 percent. Bottom-tending trawls for marine fish and invertebrates are also planned as part of the Proposed Action. Seasonally, 30 to 38 tows would occur with a modified shrimp trawl net towed at a speed of 2.9 miles per hour (2.5 knots). Further details about the length or duration of these trawls are unknown at this time. Studies on the impacts of commercial fisheries have shown that bottom trawls are one of the most significant forms of seafloor disturbance, with impacts varying based on the habitat where the trawling occurs as well as the frequency or intensity (McConnaughey et al., 2020). Although project-related trawls will take place seasonally for a few years, this area of the Gulf of Maine already experiences commercial trawling. Expected impacts from the Proposed Action would be less than those of ongoing activities.

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.

During any benthic-disturbing activities, a localized short-term increase in turbidity and sediment suspension is expected near the activities. The range of sediment suspension as a result of the Proposed Action is expected to be limited and would be based on the sediment composition, direction, and water flow rate. The sedimentation tolerance for benthic organisms varies among species and is primarily

based on their type of motility, feeding structures, and feeding modes (Hendrick et al., 2016; Jumars et al., 2015; Trannum et al., 2010). The sensitivity threshold for shellfish varies by species as well as life stage, generally with juveniles more sensitive than adults (Colden and Lipcius, 2015), but can be generalized as deposition greater than 0.79 inch (20 millimeters) (Essink, 1999). Anchor drag around the buoy could potentially result in scarring or additional disturbance to benthic habitats. Disturbance from the installation of the one FLiDAR buoy could result in a maximum impact area of 32 ft² (3 m²) from the gravity-based anchor plus the 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 disturbed area is anticipated to be small (several square meters) 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). Per the BOEM BA, live bottom features such as the sensitive bottom habitats including submerged aquatic vegetation and deep-sea corals would be avoided to reduce the risk of adverse effects (BOEM, 2023g). This protection also restricts anchoring within these live bottom features. All vessel anchoring and seafloor sampling must occur at least 492 feet (150 meters) from any known locations of threatened or endangered coral species. 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 (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 (Degreer 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, both of which aim in part to prevent the release and movement of invasive species. Adherence to these regulations would reduce the likelihood of discharge of ballast or bilge water contaminated with invasive species. All vessels in coastal waters will operate in a manner to minimize propeller wash and seafloor disturbance and transiting vessels should follow deep-water routes (e.g., marked channels), as practicable, to reduce disturbance. An estimated 980 total vessel roundtrips 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). Overall, the range expansion of invasive species is more likely to be focused in inshore, shallower waters (Adams et al., 2014; Firth et al., 2016). Due to the small volume of bilge water released, federal and state regulations related to ballast and bilge water discharge, and the small, localized areas of benthic disturbance as a result of the Proposed Action, the introduction of invasive species is considered unlikely.

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. As described in **Section 2.2.2.4**, recovery of lost equipment could be carried out in a variety of ways and depends on the type of equipment lost. Most commonly the recovery of lost survey 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. Lost survey gear would be reported within 24 hours to BSEE and NMFS. Marine debris that is not able to be retrieved could continue to cause benthic disturbance. See **Section 2.2.2.4** and **Appendix D** for additional details.

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. Per the BOEM BA, live bottom features such as the sensitive bottom habitats including submerged aquatic vegetation and deep-sea corals would be avoided to reduce the risk of adverse effects (BOEM, 2023g). 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 trawl and lobster trap 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 an SPL threshold of 150 dB re 1 μ Pa for behavioral disturbance (Greater Atlantic Regional Fisheries Office, 2020), sounds with source levels of 190 dB re μ Pa meter would fall below this threshold several hundred meters from the source (assuming $15 \times \log[R]$ 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. Lack of evidence for any source due to extreme difficulty of measuring particle motion and determining fishes' sensitivity to particle motion renders establishment of any guidelines or thresholds for particle motion exposure currently impossible (Popper and Hawkins, 2018; Popper et al., 2014). However, particle motion is expected to be dominant only within short ranges (i.e., within 33 feet [10 meters]) around the source (Harding and Cousins, 2022; Mickle and Higgs, 2022), outside of which sound pressure effects would dominate. It is therefore expected that behavioral impact ranges would be even smaller for particle motion-sensitive species, including invertebrates, as particle motion would dominate the sound field within only a few meters from the source. 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 980 vessel roundtrips over an approximately 8-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 ft² (3 m²) 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 ft² [3 m²]) 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. As identified in **Table 2-1**, bottom-tending trawls for marine fish and invertebrates are planned as part of the Proposed Action. Seasonally, 30 to 38 tows would occur with a modified shrimp trawl net towed at a speed of 2.9 miles per hour (2.5 knots). Further details about the length or duration of these trawls are not yet known. Adverse effects on finfish and invertebrates from disturbance caused by these trawl surveys would be temporary. The resources affected would recover within a short-term timeframe and there would be a negligible impact on the finfish and invertebrate assemblage within sampling areas. 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 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, 2023g).

Geotechnical and biological benthic sampling may affect the Summer Flounder and juvenile Atlantic cod HAPCs (**Figure 3-2**), areas within the GAA. 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 an inshore wet storage area. Because the juvenile Atlantic cod and Summer Flounder HAPCs are designated throughout the Gulf of Maine (**Figure 3-2**), the level of potential adverse effects on these HAPCs is unmeasurable in relation to the implementation of this Research Lease and concomitant activities (geotechnical and biological benthic sampling). 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 juvenile Atlantic cod and Summer Flounder 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 ft² (0.1 m²). During benthic sampling activities there would be an initial small sediment plume that would occur during the initial contact with the seafloor, release of the benthic grab jaw, and when the grab is retrieved from the seafloor. During this activity, the turbidity generated by this process is unmeasurable and negligible in

relation to the impacts it would have on the HAPC and EFH of Summer Flounder, juvenile Atlantic cod, or any other egg or larvae utilizing the benthic/demersal habitat being sampled. The loss and modification of the benthic habitat would result in a small grab indentation within the potential future project easements for export cables and wet storage areas. This modification of the seafloor is not expected to result in a measurable loss of any ecosystem function within the Summer Flounder and juvenile Atlantic cod HAPCs. As outlined in **Section 3.3.3**, the 0.2 acre (809 m²) of benthic habitat expected to be disturbed during vibracore and biological benthic sampling would be less than 0.000 percent of the 68,320 acres (276 km²) of the Research Lease Area. In addition, the recovery of potentially affected benthic communities would vary based on habitat and the degree of impact. Per the BOEM BA, live bottom features such as the sensitive bottom habitats, including submerged aquatic vegetation and deep-sea corals, would be avoided to reduce the risk of adverse effects (BOEM, 2023g).

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 980 vessel roundtrips over a 8-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. As described in **Section 2.2.2.4**, recovery of lost equipment could be carried out in a variety of ways and depends on the type of equipment lost. The extent of impacts would depend on the type of lost equipment and the method and 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. Lost survey gear would be reported within 24 hours to BSEE and NMFS. See **Section 2.2.2.4** and **Appendix D** for additional details.

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 trawl and lobster trap surveys, installation and removal of the FLiDAR buoy, and vessel anchoring. The recovery of

potentially affected EFH would vary based on habitat and the degree of impact. Per the BOEM BA, live bottom features such as the sensitive bottom habitats, including submerged aquatic vegetation and deep-sea corals, would be avoided to reduce the risk of adverse effects (BOEM, 2023g). Furthermore, implementation of SOC 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 SOC 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, 2023g). 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 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, 2023g). Additionally, all survey activities would follow the SOC 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 μ Pa for the potential onset of behavioral disturbance from a *non-impulsive, continuous* source of sound (e.g., vessel noise)
- SPL 160 dB re 1 μ Pa for the potential onset of behavioral disturbance from an *impulsive or nonimpulsive, 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, 2023e), but generally underwater source levels can range from 177 to 200 dB

re 1 μ Pa at 1 meter for large vessels and barges (Erbe et al., 2019; McKenna et al., 2012) and between 150 and 180 dB re 1 μ Pa 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, 2023g. 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 SOC 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 μ Pa 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 μ Pa, 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 980 vessel roundtrips over an approximately 8-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 8-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, fin whales) and other large baleen whales (e.g., 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 gear poses greater risk to smaller odontocetes and pinnipeds.

Under the Proposed Action, lobster trap surveys would utilize ropeless fishing gear, thereby eliminating the need for or use of any vertical buoy lines. Between each lobster pot would be a sinking groundline in accordance with the Atlantic Large Whale Take Risk Reduction Rule, as amended (50 CFR 229(C)). Sinking groundline minimizes the amount of line that is suspended in the water column, which reduces the potential for entanglement. Furthermore, the vessel operating the trawl (a commercial fishing

vessel) would travel at slow speeds (i.e., ~3 knots) and, in accordance with BOEM's Fisheries Survey Guidelines (BOEM, 2023b), conduct tows no longer than 20 minutes in duration. The slow speed of mobile trawl gear and the short tow times further reduce the potential for entanglements or other interactions. The application of these mitigative measures will serve to minimize and reduce entanglement risk to ESA-listed marine mammals.

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 detectable 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 SOC 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.

As described in **Section 2.2.2.4**, recovery of lost equipment could be carried out in a variety of ways and depends on the type of equipment lost. The recovery of lost equipment could affect marine mammals through the potential impact from entanglement stemming from the dragging of grapnel lines, if used. A decision to use grapnel lines and the extent of impacts would be dependent upon the type of lost equipment, which would dictate the number of attempts made at recovery, as well as coordination with agencies. Lost survey gear would be reported within 24 hours to BSEE and NMFS. See **Section 2.2.2.4** and **Appendix D** for additional details. 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 detectable 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 SOC 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 SOC 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, 2023g). 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, 2023g). 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 μ Pa 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 SOC 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 μ Pa 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 980 vessel roundtrips over an approximately 8-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 8-year span would be a relatively small amount of activity (**Section 3.3.8**). BOEM's required implementation of the SOC's 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 SOC's and mitigation measures, and the relatively low level of vessel traffic expected under the Proposed Action.

All sea turtle species are at risk of entanglement with fishing gear. 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. Trawl surveys would be limited to limited to 20 minutes or less of tow time, which would minimize the potential for interactions with sea turtles. If a sea turtle were incidentally captured, safe release, disentanglement, and rehabilitation protocols would help to reduce the severity of impacts. 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. However, no vertical buoy lines would be utilized for lobster trap surveys under the Proposed Action and sinking groundline would be used in between individual pots; these measures will effectively reduce the risk of entanglement in stationary gear for sea turtles.

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.

As described in **Section 2.2.2.4**, recovery of lost equipment could be carried out in a variety of ways and depends on the type of equipment lost. The recovery of lost equipment could affect sea turtles through entanglement risk related to the dragging of grapnel lines, if used. A decision to use grapnel lines and 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, as well as coordination with agencies. Lost survey gear would be reported within 24 hours to BSEE and NMFS. See **Section 2.2.2.4** and **Appendix D** for additional details. 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 probability 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 occur, but the resource would be expected to recover completely with proper mitigation. Implementation of SOC 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 980 vessel roundtrips would be needed to conduct routine activities over an approximately 8-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 123 vessel roundtrips per year resulting from the Proposed Action represent 0.63 percent of the average annual vessel tracks counted in the Gulf of Maine from 2019 to 2021 (**Table 3-8**) and 113 percent of the average vessels tracks counted in the requested lease area (**Table 3-9**) during the same time period. Similarly, the approximately 123 vessel roundtrips per year resulting from the Proposed Action represent 0.54 percent of the average total commercial vessel counts per year 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 8-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 km²) 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 km²) 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 USCG's final rulemaking for the recommended Portland Eastern Approach Fairway. Vessel activity over the approximately 8-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 123 vessel roundtrips per year resulting from the Proposed Action represent 0.63 percent of the average annual vessel tracks counted in the Gulf of Maine from 2019 to 2021 (**Table 3-8**) and 113 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 980 vessel roundtrips needed to conduct routine activities for the Proposed Action over an approximately 8-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 123 vessel roundtrips per year resulting from the Proposed Action represent 0.54 percent of average total commercial vessel counts per year 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. As described in **Section 2.2.2.4**, recovery of lost equipment could be carried out in a variety of ways and depends on the type of equipment lost. The extent of impacts would depend on the method of recovery and 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. See **Section 2.2.2.4** and **Appendix D** for additional details.

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; effects would occur 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 trawl and lobster trap 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 8-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. As described in **Section 2.2.2.4**, recovery of lost equipment could be carried out in a variety of ways and depends on the type of equipment lost. A common method to locate and retrieve lost equipment is by 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. Additionally, other recovery methods that minimize disturbance of the seafloor may be required after mandatory reporting of lost survey gear to BOEM, BSEE, and NMFS, as described in **Section 2.2.2.4** and **Appendix D**. 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 SOC's 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 SOC 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 SOC 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. 2023g. Wind energy research lease on the Atlantic Outer Continental Shelf offshore Maine biological assessment for the National Marine Fisheries Service.	Appendix A of the biological assessment prepared for NMFS 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.
BOEM. 2023h. Wind energy research lease on the Atlantic Outer Continental Shelf offshore Maine biological assessment for the United States Fish and Wildlife Service.	Sections 2.4.22 and 2.5.22 of the biological assessment prepared for USFWS list species conservation needs within the action area for roseate tern and rufa red knot, respectively.	All site assessment and characterization activities that could affect ESA-listed species under USFWS jurisdiction.

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-2023-0031-0002. **Appendix F** provides a summary of public comments received during both the scoping period and comment period for the Draft EA, and BOEM's responses.

6.1.3 Notice of Availability of a Draft EA

On July 21, 2023, BOEM released a Notice of Availability of a Draft EA for the Wind Energy Research Lease in the *Federal Register*. The Draft EA was available for public comment through August 21, 2023. During the comment period, BOEM held two virtual public meetings for the Draft EA on August 1 and August 3, 2023.

During the 30-day comment period, BOEM received 16 unique comment submissions from representatives of federal and state government entities, business associations, advocacy groups, and the general public, including 4 comments made verbally during the virtual public meetings. Comments reiterated ideas conveyed during the public scoping period as well as:

- Indicated that USCG has no objection to BOEM issuing a research lease in a different portion of the Research Lease Area that does not intersect with the proposed Portland Eastern Approach Fairway
- Recommended additional mitigation measures or monitoring
- Requested review of additional data or citation of studies

The comments can be viewed at www.regulations.gov by searching for docket ID BOEM-2023-0042. **Appendix F** provides a summary of public comments received during both the scoping period and comment period for the Draft EA, and BOEM's responses.

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. USFWS provided comments on the BA to BOEM on September 6, 2023. BOEM sent revised BAs on

October 20, 2023, and April 11, 2024, and USFWS provided additional comments on March 8, 2024, and April 17, 2024, respectively. BOEM submitted the final BA to USFWS on April 24, 2024. USFWS provided concurrence with BOEM's determination on May 15, 2024.

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, 2023g). Appendix A of the NMFS BA contains an updated list of project design criteria and best management practices confirmed through consultation for this Proposed Action. 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. NMFS provided comments on the BA on October 27, 2023. BOEM sent revised BAs on December 8, 2023. NMFS provided additional comments on the BA on February 16, 2024. BOEM submitted the final BA to NMFS on April 24, 2024. NMFS provided concurrence with BOEM's determination on May 17, 2024.

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. NMFS issued a letter to BOEM on October 24, 2023, providing general comments on EFH and listing specific conservation recommendations to avoid, minimize, and offset significant impacts on EFH and HAPCs. BOEM issued a response to NMFS's conservation recommendations on March 11, 2024.

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.

After review of the consistency determinations, the coastal programs of Massachusetts, New Hampshire, and Maine issued letters on September 1, September 7, and September 15, 2023, respectively, indicating their concurrence 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. On July 25, 2023, BOEM sent invitations to consult to six additional federally recognized tribes: Mashantucket (Western) Pequot Tribal Nation, Mashpee Wampanoag Tribe, Mohegan Tribe of Indians of Connecticut, Narragansett Indian Tribe, Shinnecock Indian Nation, and Wampanoag Tribe of Gay Head (Aquinnah). 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 comments and input concerning the identification and potential impacts on historic properties. Additionally, the recipients were invited to actively participate as consulting parties in the review process. The following recipients responded to the invitation to participate as consulting parties: Mashantucket (Western) Pequot Tribal Nation. BOEM continued consultation with tribes that did not respond to the invitation to be consulting parties. On September 11, 2023, BOEM met with the Maine SHPO and staff to discuss this undertaking and BOEM's initial Finding of No Historic Properties Affected.

Consistent with 36 CFR 800.4(d)(1), on September 29, 2023, BOEM issued a Finding of No Historic Properties Affected to federally recognized tribes, Maine SHPO, and consulting parties; requested concurrence on the Finding from the Maine SHPO; and invited comments from federally recognized tribes and consulting parties. On October 16, 2023, the Maine SHPO provided a letter concurring with the Finding and associated stipulations regarding prehistoric and historic archaeological resources. BOEM issued the final Finding of No Historic Properties Affected with the Maine SHPO's concurrence letter attached to federally recognized tribes, Maine SHPO, and consulting parties on November 9, 2023.

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 ancestral 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.

On August 17, 2023, BOEM held a tribal meeting to provide information about the State of Maine's research lease, NEPA process, and opportunities to provide comments. The meeting was attended by a representative for the Passamaquoddy Tribe.

On September 15, 2023, BOEM held another meeting with representatives for the Passamaquoddy Tribe, which covered topics including fisheries, traditional use areas, viewsheds, whale deaths, Passamaquoddy economic development, offshore wind farm terrestrial use including landfalls and staging areas, inequalities in community benefit agreements, and traditional ecological knowledges.

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	
Ajilore, Ololade	Navigation and Vessel Traffic
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	
Tuxbury, Susan	Fishery Biologist
USACE	
Brien, Ruthann	Regulatory Project Manager
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
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
Hallman, Ryan	Air Quality Support
Hartfelder, Kelsey	Air Quality Support
Hatfield, Teresa	Navigation and Vessel Traffic
Jost, Rebecca	Military Use; Recreation and Tourism
Lassell, Susan	Section 106 Lead
Mendoza, Tiffany	Public Involvement Lead
Nally, Dan	Project Manager
O'Donnell, Megan	USFWS Biological Assessment and Coastal Zone Management Lead
Osani, Sam	Cultural Resources and Section 106 Support
Quirk, Phillip	Cultural Resources Lead; Section 106 Support
Read, Brent	GIS Lead
Wheaton, Jenna	Section 106 Support
Zaccagnino, Jimmy	Comment Analysis; Other Support
CSA Ocean Sciences Inc.	
Balcom, Brian	Ecosystem-based Management Specialist
Barkaszi, Mary Jo	ESA and NMFS Biological Assessment Lead
Hartigan, Kayla	Sea Turtles
Martin, Tony	Finfish, Invertebrates, and EFH Assessment Lead
McMahon, Adrianna	Benthic Resources
Murray, Deb	Document Processing

Name	Role/Resource Area
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 Trap Surveys ¹⁰	Fishing (C1/C2)	Bristol, ME	90	45	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	2029	2022	2023	2024	2025	2026	2027	2028	2029
FLiDAR Buoy-based Acoustic Monitoring	Apr 24	Apr 26	4	-	-	2	1	1	-	-	-	-	-	25	12	12	-	-	-
Geophysical Reconnaissance Surveys	Sep 24	Nov 24	15	-	-	15	-	-	-	-	-	-	-	5,040	-	-	-	-	-
	Sep 24	Nov 24	60	-	-	60	-	-	-	-	-	-	-	1,440	-	-	-	-	-
High-Resolution Geophysical Surveys	Mar 25	May 25	15	-	-	-	15	-	-	-	-	-	-	-	5,040	-	-	-	-
	Mar 25	May 25	60	-	-	-	60	-	-	-	-	-	-	-	1,440	-	-	-	-
Geotechnical Surveys	Mar 25	Nov 25	30	-	-	-	30	-	-	-	-	-	-	-	10,080	-	-	-	-
Benthic Surveys	-	-	-	-	-	-	-	-	-	--	--	--	--	--	--	--	--	--	--
Seafloor Habitat Characterization Sampling and Surveys	Jan 23	Feb 29	70	-	10	10	10	10	10	10	10	-	240	240	240	240	240	240	240
Physical Oceanographic Monitoring	Jul 23	Feb 29	34	-	3	6	6	6	6	6	1	-	29	58	58	58	58	58	10
Digital Aerial Surveys	May 23	Mar 26	28	-	3	10	12	3	-	-	-	-	9	30	36	9	-	-	-
Visual Wildlife Surveys	Oct 22	Feb 29	154	6	24	24	24	24	24	24	4	57	229	229	229	229	229	229	38
Passive Acoustic Monitoring of Marine Mammals and Ambient Noise	Jun 24	Feb 29	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	Oct 22	Feb 29	78	4	12	12	12	12	12	12	2	52	156	156	156	156	156	156	26
Passive Acoustic Monitoring of Large Pelagic and Benthic Fish	Jul 22	Feb 29	64	8	8	8	8	8	8	8	8	104	104	104	104	104	104	104	104
Bottom Trawl Surveys for Marine Fish and Invertebrates	Oct 24	Feb 29	108	-	-	6	24	24	24	24	6	-	-	134	538	538	538	538	134
Plankton and Larval Lobster Surveys	Oct 23	Feb 29	130	-	6	24	24	24	24	24	4	-	134	538	538	538	538	538	90
Lobster Trap Surveys	Sep 24	Feb 29	110	-	-	8	24	24	24	24	6	-	-	202	605	605	605	605	151
Totals: ³			1,008	18	66	193	258	144	140	140	49	213	901	8,278	19,158	2,571	2,549	2,549	876

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 ₂ O (metric tons)	CO ₂ e ¹ (metric tons)
2022	0.902	0.021	0.021	0.029	0.152	0.0006	54.331	0.0005	0.0027	55.1
2023	3.521	0.085	0.082	0.118	0.683	0.0024	212.3	0.0021	0.0104	215.5
2024	183.440	3.059	2.966	2.276	33.955	0.0889	8,697.6	0.0396	0.4253	8,825.3
2025	462.796	7.658	7.428	5.580	85.331	0.2225	21,863.03	0.0968	1.0691	22,184.1
2026	11.981	0.276	0.268	0.374	2.073	0.0076	723.95	0.0065	0.0355	734.7
2027	11.902	0.274	0.266	0.370	1.977	0.0073	719.20	0.0064	0.0353	729.9
2028	11.902	0.274	0.266	0.370	1.977	0.0073	719.20	0.0064	0.0353	729.9
2029	3.458	0.084	0.082	0.117	0.588	0.002	209.867	0.002	0.010	213.0
Totals:²	689.903	11.732	11.379	9.235	126.737	0.339	33,199.502	0.160	1.624	33,687.4

¹ Global Warming Potential: CO₂ = 1; N₂O = 298; CH₄ = 25

² Totals may not add due to rounding.

CH₄ = methane; CO₂ = carbon dioxide; N₂O = 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 ₂ O (metric tons)	CO ₂ e 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	6433.15	0.0274	0.3146	6,527.6
	Crew and Supply	39.192	0.642	0.622	0.452	7.216	0.0186	1837.71	0.0078	0.0899	1,864.7
High-Resolution Geophysical Surveys	Tugboat	137.198	2.246	2.179	1.582	25.262	0.0652	6433.15	0.0274	0.3146	6,527.6
	Crew and Supply	39.192	0.642	0.622	0.452	7.216	0.0186	1837.71	0.0078	0.0899	1,864.7
Geotechnical Surveys	Tugboat	274.397	4.493	4.358	3.165	50.524	0.1304	12866.30	0.0548	0.6292	13,055.2
Benthic Surveys ²	--	--	--	--	--	--	--	--	--	--	--
Seafloor Habitat Characterization Sampling and Surveys	Work Boat	4.161	0.121	0.117	0.185	0.770	0.0026	256.02	0.0032	0.0127	259.9
Physical Oceanographic Monitoring	Work Boat	0.808	0.023	0.023	0.036	0.150	0.0005	49.74	0.0006	0.0025	50.5
Digital Aerial Surveys	4-Place Piston Engine Aircraft	0.085	0.003	0.002	0.020	0.793	0.0023	5.99	0.0009	0.0001	6.0
Visual Wildlife Surveys	Crew and Supply	8.238	0.174	0.169	0.215	1.345	0.0049	486.52	0.0037	0.0238	493.7
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)	6.315	0.136	0.132	0.175	1.015	0.0039	380.77	0.0030	0.0186	386.4
Passive Acoustic Monitoring of Large Pelagic and Benthic Fish	Work Boat	2.061	0.060	0.058	0.091	0.381	0.0013	126.79	0.0016	0.0063	128.7
Bottom Trawl Surveys for Marine Fish and Invertebrates	Fishing (C1/C2)	15.066	0.324	0.314	0.418	2.421	0.0092	908.45	0.0072	0.0444	921.9
Plankton and Larval Lobster Surveys	Work Boat	7.213	0.209	0.203	0.320	1.334	0.0045	443.76	0.0055	0.0219	450.4
Lobster Trap Surveys	Fishing (C1/C2)	17.264	0.371	0.360	0.479	2.774	0.0105	1,040.9	0.0082	0.0509	1,056.3
Totals: ⁵		689.903	11.732	11.379	9.235	126.737	0.339	33,199.5	0.160	1.624	33,687.4

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: CO₂ = 1; N₂O = 298; CH₄ = 25

⁵ Totals may not add due to rounding.

CH₄ = methane; CO₂ = carbon dioxide; N₂O = 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 ₂ O (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 ₂ O (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 ₂ O (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 ₂ O (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 Trap 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

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, PM₁₀, PM_{2.5}, VOC, CO, and CH₄ 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 CO₂ and SO₂ were sourced from Table H.7 of EPA, 2022c and assume the use of uncontrolled Tier 0 engines.

⁵ Emission factors for N₂O 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.

CH₄ = methane; CO₂ = carbon dioxide; g = grams; kW = kilowatt; kWh = kilowatt-hours; N₂O = 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 ₂ O (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 ₂ O (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, PM₁₀, PM_{2.5}, VOC, CO, and CH₄ 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 CO₂ and SO₂ were sourced from Table H.7 of EPA, 2022c and assume the use of uncontrolled Tier 0 engines.

⁵ Emission factors for N₂O 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.

CH₄ = methane; CO₂ = carbon dioxide; g = grams; kW = kilowatt; kWh = kilowatt-hours; N₂O = 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 ₂ O (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.

SO₂ emissions were calculated assuming a fuel sulfur content of 0.05% and assuming that 100% of fuel sulfur is converted to SO₂.

CO₂ emissions were calculated assuming 23 kg of fuel is burned per hour (FOCA, 2007) and 3,101 kg of CO₂ emitted per metric ton of aviation gas (WRI, 2017). Therefore, 3.101 kg of CO₂ are emitted per kg of aviation gas. Assuming 23 kg of aviation gas per hour, the CO₂ emission rate is 71.323 kg/hour, or 71,323 g/hour.

CH₄ emissions were calculated assuming 23 kg of fuel is burned per hour (FOCA, 2007) and 0.443 kg of CH₄ emitted per metric ton of aviation gas (WRI, 2017). Therefore, 4.43E-4 kg of CH₄ are emitted per kg of aviation gas. Assuming 23 kg of aviation gas per hour, the CH₄ emission rate is 0.0102 kg/hour, or 10.19 g/hour.

N₂O emissions were calculated assuming 23 kg of fuel is burned per hour (FOCA, 2007) and 0.02658 kg of N₂O emitted per metric ton of aviation gas (WRI, 2017). Therefore, 2.66E-5 kg of N₂O are emitted per kg of aviation gas. Assuming 23 kg of aviation gas per hour, the N₂O 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).

CH₄ = methane; CO₂ = carbon dioxide; kg = kilograms; g = grams; LTO = landing and take-off cycle; N₂O = 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 ₂ O (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.

CO₂, CH₄, and N₂O 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.

CH₄ = methane; CO₂ = carbon dioxide; g = grams; LTO = landing and take-off cycle; N₂O = 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 February 2029, 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.

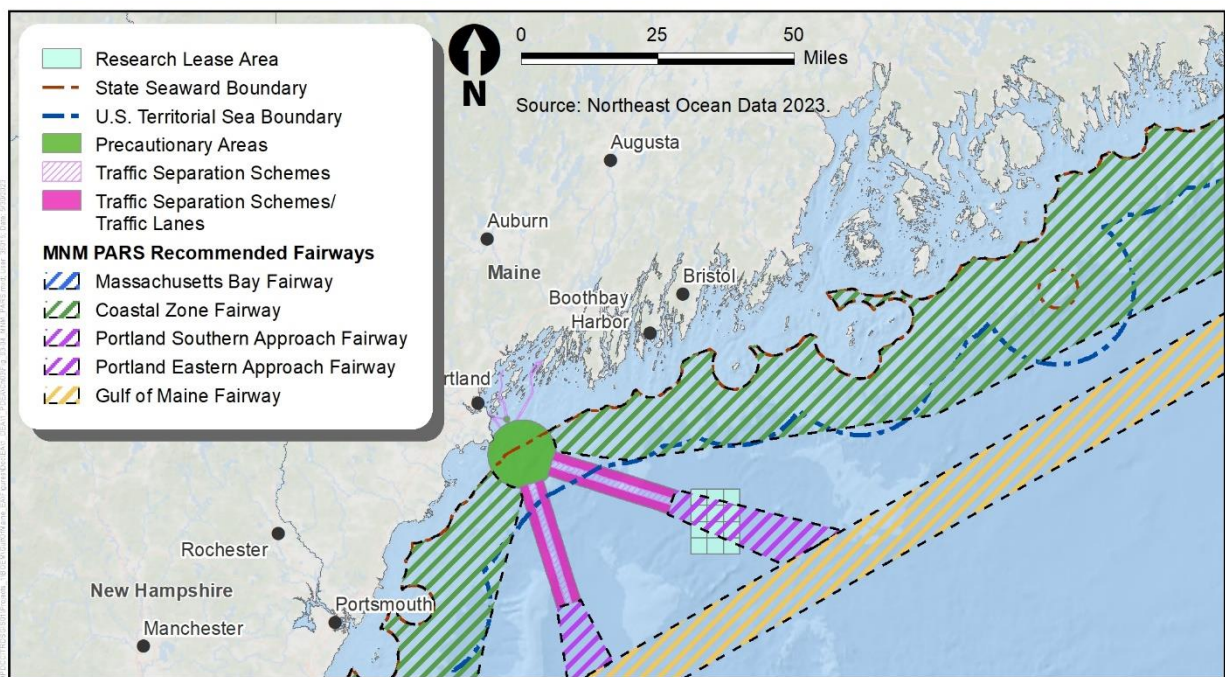


Figure C-1. Approaches to Maine, New Hampshire, and Massachusetts Port Access Route Study recommended fairways

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, 2023d). 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, 2023c). 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).

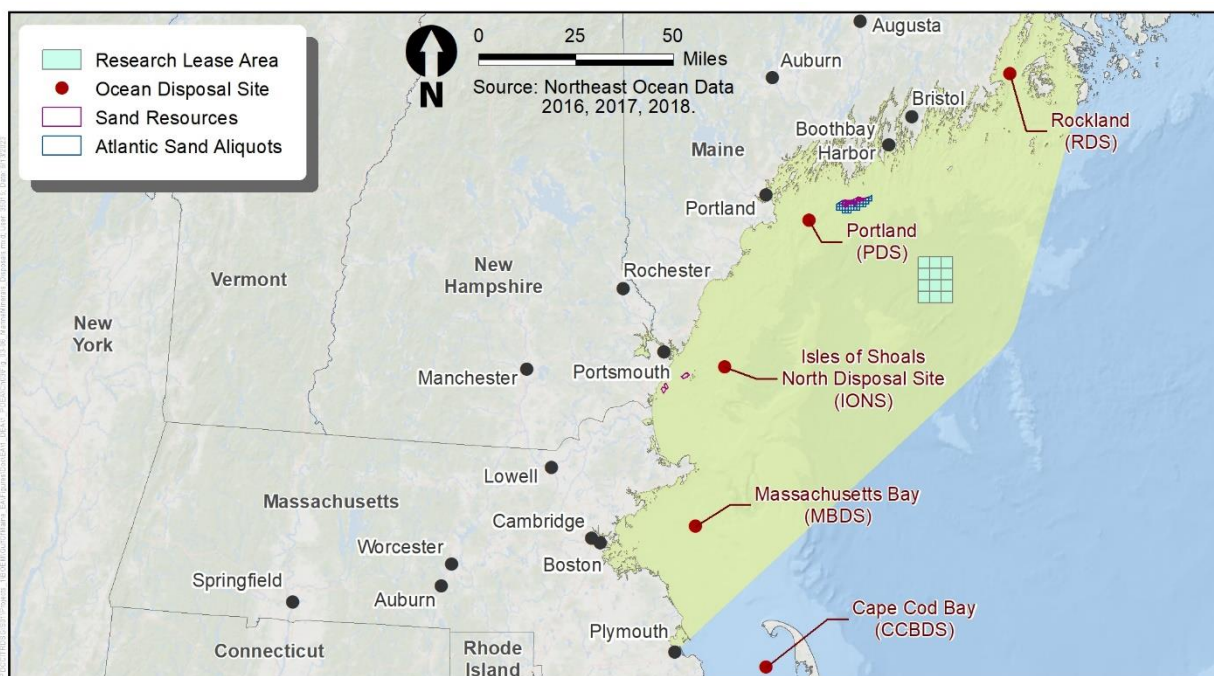


Figure C-2. Marine mineral and ocean disposal sites in the vicinity of the Research Lease Area within the Gulf of Maine

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-km²) 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). The Gulf of Maine sea surface water temperatures have been increasing faster than most waters around the world (Seidov et al., 2021), rising an average 0.026°C per year since 1982, accelerating to 0.26°C after 2004 (Mills et al., 2013). Regional studies on the decadal warming of the Gulf of Maine have shown to be unique to normal variability and may signal a shift of the thermal regime (Seidov et al., 2021). The waters of the Scotian Shelf and slope waters have been warming at a higher rate than the Gulf of Maine recently (Seidov et al., 2021). This issue is

multifaceted and will continue to require further studies to better understand the ecological implications.

- 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). Sustained monitoring of zooplankton populations in the western Gulf of Maine from 2005 to 2022 indicates a substantial decline in abundance of the energy-rich stages of the planktonic copepod, *Calanus finmarchicus*, in the Gulf of Maine in summer and fall, during critical feeding times for forage fish and NARW (BOEM, 2023f).
- 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 SOC's and mitigation that are part of the Proposed Action. The SOC's 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, 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. By signing the lease, the Lessee acknowledges that there is not coverage under the ESA Section 7(a)(2) for the use of fixed fishing gear vertical lines (i.e., lines between the bottom fishing gear and surface marking/retrieval buoys that pose a risk of entanglement to large whales. BOEM's ESA biological assessment and consultation with NMFS includes only lobster trap surveys that utilize ropeless gear technology.

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 found in BOEM's notice (<https://www.boem.gov/sites/default/files/documents/BMPs>) last revised on November 22, 2021. The 2021 Biological Assessment (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 Mapped Sensitive Habitat/Sensitive Species

- 3.1 Mapped Sensitive Habitat/Sensitive Species. Lessee is required to provide vessel operators with known sensitive habitats, including HAPCs and HMAs, as well as sensitive species point locations for deep-sea corals and sponges for site assessment and site characterization activities. The Lessee should be prepared to provide evidence of compliance of this request, if requested.

4 Sensitive Habitat Avoidance

- 4.1 Sensitive Habitat Avoidance. To the maximum extent practicable, the Lessee shall conduct bottom disturbing site assessment and site characterization activities (CPT, borings) to avoid or minimize impacts to slopes with gradients ≥ 10 degrees, complex habitat, boulders ≥ 0.5 meters, and deep-water corals and demonstrate in any submitted RAP that these features shall be avoided to the maximum extent practicable.

5 Archaeological Survey Requirements

- 5.1 Archaeological Survey Required. The Lessee must provide the results of an archaeological survey with its plans.
- 5.2 Qualified Marine Archaeologist. The Lessee must ensure that the analysis of archaeological survey data collected in support of plan (e.g., SAP and/or RAP) submittal and the preparation of archaeological reports in support of plan submittal are conducted by a Qualified Marine Archaeologist.
- 5.3 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. Unless written documentation is received from a Tribe indicating a lack of interest in engaging, the Lessee should engage, at a minimum, 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;
 - Passamaquoddy Tribe of Indians- Pleasant Point;
 - 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 3.1 of the lease). The Lessee must provide the Lessor with documentation of compliance with this stipulation prior to commencement of surveys.

- 5.4 Geotechnical Exploration. The Lessee may only conduct geotechnical exploration activities performed in support of plan (i.e., SAP and/or RAP) submittal in locations where an analysis of the results of geophysical surveys has been completed. The analysis must demonstrate avoidance of anthropogenic hazards and MEC/UXOs by a minimum of 15 meters. 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 6.6.4, 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 High Resolution Geophysical (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.
- 5.5 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 RAP) 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.
- 5.6 No Impact without Approval. In no case may the Lessee knowingly impact a potential archaeological resource without the Lessor's prior approval.
- 5.7 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 RAP) submittal and after review of the location by a Qualified Marine Archaeologist under 6.6.2 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:
- 5.7.1 Immediately halt seafloor/bottom-disturbing activities within the area of discovery;
 - 5.7.2 Notify the Lessor within 24 hours of discovery;
 - 5.7.3 Notify the Lessor in writing via report to the Lessor within 72 hours of its discovery;
 - 5.7.4 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

- 5.7.5 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 (NRHP) (30 CFR 585.702(b)). If investigations indicate that the resource is potentially eligible for listing in the NRHP, 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 585.702(c-d)).

6 Avian and Bat Survey and Reporting Requirements

- 6.1 Lighting: Any lights used to aid marine navigation by the Lessee during construction, operations, and decommissioning activities 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.
- 6.2 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' Offshore Motus network.
- 6.3 Acoustic Detectors for Bats: The Lessee must install acoustic detectors for bats on survey vessels to supplement the data captured by the single FLiDAR buoy and are important to capture bat activity at the margins of or in proximity to the Research Lease Area, especially in the areas closest to land. The Service will provide a bat survey and monitoring protocol for the applicant to use as guidelines for acoustic detections.
- 6.4 Bird Deterrents: To minimize the attraction of birds on data buoys, the Lessee must install bird deterrent devices (e.g., anti-perching), where appropriate.
- 6.5 Avian Annual Reporting: The Lessee must provide an annual report to both 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>. Additionally, annual reporting of injured or dead listed species will be recorded in the Injury & Mortality Reporting (IMR) system (<https://ecos.fws.gov/imr/welcome>).

- 6.6 Survey Results and Data: The Lessee must provide the results of avian surveys and data to BOEM and USFWS with its plans.
- 6.7 The Lessee must use approved oil spill response plan (OSRP) mitigation measures, as necessary, to prevent birds from going to affected areas including chumming, hazing, and relocating to unaffected areas.

7 Fishery Monitoring Conditions for Endangered and Threatened Species

- 7.1 The Lessee must ensure that all trap/pot gear follow required best practices, including:
- All sampling gear will be hauled at least once every 30 days, and all gear will be removed from the water and stored on land between sampling 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).
 - Knot-free buoy lines will be used to the extent practicable.
- 7.2 The Lessee must ensure that all trap/pot 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.
- 7.3 Reserved.
- 7.4 The Lessee must ensure that any survey gear lost is reported to BSEE within 24 hours of the documented time when gear is discovered to be missing or lost and recovered according to BOEM and BSEE Marine Debris Elimination and Reporting requirements (at TIMS Web Portal for marine trash and debris with notification email to marinedebris@bsee.gov). All lost gear must also be reported to NMFS Greater Atlantic Regional Fisheries Office, Protected Resources Division (at nmfs.gar.incidental-take@noaa.gov). This report must include information on any markings on the gear and any efforts undertaken or planned to recover the gear.
- 7.5 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.

- 7.6 The Lessee must ensure trawl surveys would not be carried out in water depths shallower than 197 feet (60 meters) to minimize the potential for interaction with Atlantic sturgeon.
- 7.7 The Lessee must ensure all vessels deploying fixed gear (e.g., 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 Guidelines³ and the procedures described in “Careful Release Protocols for Sea Turtle Release with Minimal Injury.”⁴
- 7.8 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.⁵ Biological data, samples, and tagging must occur as outlined below:
- 7.8.1 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, 2023g).
- 7.8.2 The Lessee must follow the Sturgeon and Sea Turtle Take Standard Operating Procedures.⁶
- 7.8.3 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 form⁷ 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).
- 7.8.4 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.⁸
- 7.8.4.1 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

³ <https://www.reginfo.gov/public/do/DownloadDocument?objectID=102486501>

⁴ <https://repository.library.noaa.gov/view/noaa/3773>

⁵ <https://media.fisheries.noaa.gov/2021-07/Take%20Report%20Form%2007162021.pdf?null>

⁶ <https://media.fisheries.noaa.gov/2021-11/Sturgeon-Sea-Turtle-Take-SOPs-external-11032021.pdf>

⁷ <https://media.fisheries.noaa.gov/2021-07/Take%20Report%20Form%2007162021.pdf?null>

⁸ https://media.fisheries.noaa.gov/dam-migration/sturgeon_genetics_sampling_revised_june_2019.pdf

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.

- 7.8.4.2 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.⁹
- 7.8.5 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 Form¹⁰ 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).
- 7.8.6 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:
 - 7.8.6.1 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.
 - 7.8.6.2 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.¹¹ These handling and resuscitation procedures must be executed any time a sea turtle is incidentally captured and brought onboard a survey vessel.
 - 7.8.6.3 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

⁹ <https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-take-reporting-programmatics-greater-atlantic>

¹⁰ <https://media.fisheries.noaa.gov/2021-07/Take%20Report%20Form%2007162021.pdf?null>

¹¹ https://media.fisheries.noaa.gov/dam-migration/sea_turtle_handling_and_resuscitation_measures.pdf

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.

- 7.8.6.4 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.¹²
- 7.8.6.5 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.
- 7.8.7 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.¹³ 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, 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.
- 7.8.8 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

¹² <https://media.fisheries.noaa.gov/dam-migration-miss/Resuscitation-Cards-120513.pdf>

¹³ <https://media.fisheries.noaa.gov/2021-07/Take%20Report%20Form%2007162021.pdf?null>

took place during the season, including location of gear set, duration of soak/haul, and total effort. The report on survey activities must be comprehensive of all activities, regardless of whether ESA-listed species were observed.

Appendix E: Literature Cited

- Adams TP, Miller RG, Aleynik D, Burrows MT. 2014. Offshore marine renewable energy devices as stepping stones across biogeographical boundaries. *Journal of Applied Ecology*. 51(2):330-338.
- Anderson J. 2021. Letter to J.F. Bennett concerning the effects of certain site assessment and site characterization activities to be carried out to support the siting of offshore wind energy development projects off the U.S. Atlantic coast. 68 p.
- Auster P, Kilgour M, Packer D, Waller R, Auscavitch S, Watling L. 2013. Octocoral gardens in the Gulf of Maine (NW Atlantic). *Biodiversity*. 14(4):193. doi:10.1080/14888386.2013.850446.
- Auster P, Packer D, Waller R, Auscavitch S, Kilgour M, Watling L, Nizinski M, Babb I, Johnson D, Pessutti J, Drohan A, Kinlan B. 2015. Imaging surveys of select areas in the northern Gulf of Maine for deep-sea corals and sponges during 2013-2014. Report to the New England Fishery Management Council.
- 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: Bureau of Ocean Energy Management. 201 p. Report No.: OCS Study BOEM 2019-036. [accessed May 15, 2023].
<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>.
- Azzara AJ, von Zharen WM, Newcomb JJ. 2013. Mixed-methods analytical approach for determining potential impacts of vessel noise on sperm whale click behavior. *The Journal of the Acoustical Society of America*. 134:4566. <https://pubs.aip.org/asa/jasa/article-abstract/134/6/4566/945425/Mixed-methods-analytic-approach-for-determining?redirectedFrom=fulltext>. doi:10.1121/1/4828819.
- Balch WM, Drapeau DT, Bowler BC, Record NR, Bates NR, Pinkham S, Garley R, Mitchell C. 2022. Changing hydrographic, biogeochemical, and acidification properties in the Gulf of Maine as measured by the Gulf of Maine North Atlantic Time Series, GNATS, between 1998 and 2018. *Journal of Geophysical Research: Biogeosciences*. 127(6):e2022JG006790.
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9287075/pdf/JGRG-127-0.pdf>.
- Baumgartner MF, Lysiak NSJ, Schuman C, Urban-Rich J, Wenzel FW. 2011. Diel vertical migration behavior of *Calanus finmarchicus* and its influence on right and sei whale occurrence. *Marine Ecology Progress Series*. 423:167–184. <https://doi.org/10.3354/meps08931>.
- Baumgartner MF, Wenzel FW, Lysiak NSJ, Patrician MR. 2017. North Atlantic right whale foraging ecology and its role in human-caused mortality. *Marine Ecology Progress Series*. 581:165–181.
<https://doi.org/10.3354/meps12315>.

- Benson PT, Enterline CE. 2021. Interim 2021 Memo report: Seafloor mapping and field sampling in Casco Bay, Maine. West Boothbay Harbor, ME: Maine Coastal Mapping Initiative, Maine Coastal Program.
https://www.maine.gov/dmr/sites/maine.gov.dmr/files/docs/2021_April_Aug_Memo_Report%20_AllSeasonFinal.pdf.
- Bigelow HB, Schroeder WC. 1953. Fishes of the Gulf of Maine. 577 p. U.S. Fish and Wildlife Service Fishery Bulletin 53.
- Bjorndal KA. 1997. Foraging Ecology and Nutrition of Sea Turtles. In: Lutz PL, Musick JA, editors. The Biology of Sea Turtles. Boca Raton, FL: CRC Press. p. 199-231.
- Blunden J, Arndt DS. 2020. State of the climate in 2019. Bulletin of the American Meteorological Society. 101(8):S1–S429.
<https://journals.ametsoc.org/downloadpdf/journals/bams/101/8/2020BAMSStateoftheClimate.pdf>. doi:10.1175/2020BAMSStateoftheClimate.1.
- BOEM. 2012a. Atlantic Region Wind Energy Development: Recreation and Tourism Economic Baseline Development, Impacts of Offshore Wind on Tourism and Recreation Economies. OCS Study BOEM 2012-085. <https://coast.noaa.gov/data/digitalcoast/pdf/atlantic-region-wind-energy.pdf>.
- BOEM. 2012b. Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New Jersey, Delaware, Maryland, and Virginia: Final Environmental Assessment. Sterling, VA: U.S. Department of the Interior, Bureau of Ocean Energy Management. 366 p. OCS EIS/EA BOEM 2012-003.
https://www.boem.gov/sites/default/files/uploadedFiles/BOEM/Renewable_Energy_Program/Smart_from_the_Start/Mid-Atlantic_Final_EA_012012.pdf.
- BOEM. 2013. Commercial wind lease issuance and site assessment activities on the Atlantic Outer Continental Shelf offshore Rhode Island and Massachusetts: Revised environmental assessment. Sterling, VA: U.S. Department of the Interior, Bureau of Ocean Energy Management. 417 p. Report No.: OCS EIS/EA BOEM 2013-1131.
- BOEM. 2014a. Atlantic OCS Proposed Geological and Geophysical Activities Mid-Atlantic and South Atlantic Planning Areas: Final Programmatic Environmental Impact Statement. New Orleans, LA: U.S. Department of the Interior, Bureau of Ocean Energy Management. 2328 p. OCS EIS/EA BOEM 2014-001. <https://www.boem.gov/oil-gas-energy/atlantic-geological-and-geophysical-gg-activities-programmatic-environmental-impact>.
- BOEM. 2014b. Commercial wind lease issuance and site assessment activities on the Atlantic Outer Continental Shelf offshore Massachusetts: Revised environmental assessment. Sterling, VA: U.S. Department of the Interior, Bureau of Ocean Energy Management. 674 p. Report No.: OCS EIS/EA BOEM 2014-603.
- BOEM. 2016. Commercial wind lease issuance and site assessment activities on the Atlantic Outer Continental Shelf offshore New York: Revised environmental assessment. Sterling, VA: U.S. Department of the Interior, Bureau of Ocean Energy Management. 449 p. Report No.: OCS EIS/EA BOEM 2016-070.

- BOEM. 2018. BOEM Tribal Consultation Guidance. Washington, DC:
<https://www.boem.gov/sites/default/files/about-boem/Public-Engagement/Tribal-Communities/BOEM-Tribal-Consultation-Guidance-with-Memo.pdf>.
- BOEM. 2020. Guidelines for providing archaeological and historic property information pursuant to 30 CFR Part 585. Sterling, VA: 23 p. [accessed 2023 May 31].
<https://www.boem.gov/sites/default/files/documents/about-boem/Archaeology%20and%20Historic%20Property%20Guidelines.pdf>.
- BOEM. 2021a. BOEM Offshore Wind Energy Facilities Emission Estimating Tool - Version 2.0 User's Guide, BOEM 2021-046. <https://www.boem.gov/sites/default/files/documents/about-boem/BOEM-Wind-Power-User-Guide-V2.pdf>.
- BOEM. 2021b. Commercial and research wind lease and grant issuance and site assessment activities on the Atlantic Outer Continental Shelf of the New York Bight: Final environmental assessment. Sterling, VA: U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. 219 p. [accessed 2023 May 31].
https://www.boem.gov/sites/default/files/documents//NYBightFinalEA_BOEM_2021-073.pdf.
- BOEM. 2021c. Data Collection and Site Survey Activities for Renewable Energy on the Atlantic Outer Continental Shelf: Biological Assessment. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. 152 p.
<https://www.boem.gov/sites/default/files/documents/renewable-energy/OREP-Data-Collection-BA-Final.pdf>.
- BOEM. 2022a. Conditions of construction and operations plan approval. Lease number OCS-A 0517. Washington, DC: 93 p. [accessed 2023 May 24].
<https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/SFWF-COP-Terms-and-Conditions.pdf>.
- BOEM. 2022b. Decision Memorandum: Gulf of Maine Request for Competitive Interest (RFCI). Washington, DC: 25 p. [accessed 2023 May 15].
<https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/GoME%20RFCI%20Decision%20Memo.pdf>.
- BOEM. 2023a. BOEM announces determination of no competitive interest for Gulf of Maine research lease application. Washington, DC: Bureau of Ocean Energy Management, Office of Public Affairs. [accessed 2023 May 15]. <https://www.who.edu/press-room/news-release/woods-hole-oceanographic-institution-led-study-explores-effects-of-noise-on-marine-life/>.
- BOEM. 2023b. Guidelines for Providing Information on Fisheries for Renewable Energy Development on the Atlantic Outer Continental Shelf Pursuant to 30 CFR Part 585. 22 p.
<https://www.boem.gov/sites/default/files/documents/about-boem/Fishery-Survey-Guidelines.pdf>.
- BOEM. 2023c. Marine mineral information system. [accessed 2023 May 24].
<https://mmis.doi.gov/BOEMMMIS/>.

- BOEM. 2023d. Marine Minerals: Requests and Active Leases. <https://www.boem.gov/marine-minerals/requests-and-active-leases>.
- BOEM. 2023e. Sound Source List: A description of sounds commonly produced during ocean exploration and industrial activity. 69 p. BOEM 2023-016.
- BOEM. 2023f. Sustained monitoring of zooplankton populations at the Coastal Maine Time Series (CMTS) and Wilkinson Basin Time Series (WBTS) stations in the western Gulf of Maine: Results from 2005-2022. Sterling, VA: 40 p. Report No.: OCS Study BOEM 2023-015. Contract No.: CA M19AC00022. <https://www.govinfo.gov/content/pkg/GOVPUB-I-e5ff4b34ab698bf38fa3442171c1513d/pdf/GOVPUB-I-e5ff4b34ab698bf38fa3442171c1513d.pdf>.
- BOEM. 2023g. Wind energy research lease on the Atlantic Outer Continental Shelf offshore Maine biological assessment for the National Marine Fisheries Service.
- BOEM. 2023h. Wind energy research lease on the Atlantic Outer Continental Shelf offshore Maine biological assessment for the United States Fish and Wildlife Service.
- BOEM. 2023i. Wind energy research lease on the Atlantic Outer Continental Shelf offshore Maine essential fish habitat assessment for the National Marine Fisheries Service.
- BOEM, U.S. Army Corps of Engineers (USACE). 2013. Endangered Species Act Section 7 Consultation biological opinion. Commercial wind lease issuance and site assessment activities on the Atlantic Outer Continental Shelf in Massachusetts, Rhode Island, New York and New Jersey Wind Energy Areas. Concord, MA: 255 p. NER-2012-9211 GARFO-2012-00011.
- Booth DT, Archibald-Binge A, Limpus CJ. 2020. The effect of respiratory gases and incubation temperature on early stage embryonic development in sea turtles. PLOS ONE. 15(12):e0233580. <https://doi.org/10.1371/journal.pone.0233580>.
- Brooks R, Purdy C, Bell S, Sulak K. 2006. The benthic community of the eastern US continental shelf: A literature synopsis of benthic faunal resources. Continental Shelf Research. 26(6):804–818. doi:10.1016/j.csr.2006.02.005.
- Buckstaff KC. 2006. Effects of watercraft noise on the acoustic behavior of bottlenose dolphins, *Tursiops Truncatus* in Sarasota Bay, Florida. Marine Mammal Science. 20(4):709-725. doi:10.1111/j.1748-7692.2004.tb01189.x.
- Burgess D. 2022. State of Maine comments on BOEM’s Request for Interest (RFI) in commercial leasing for wind energy development on the Gulf of Maine Outer Continental Shelf [official communication; letter from State of Maine, Governor’s Energy Office on 2022 Oct 3].
- Burke VJ, Morreale SJ, Standora EA. 1994. Diet of the Kemp's ridley sea turtle, *Lepidochelys kempii*, in New York waters. Fishery Bulletin. 92:26–32.
- Byles RA. 1988. Behavior and ecology of sea turtles from Chesapeake Bay, Virginia. The College of William and Mary.

- Carr AF, Caldwell DK. 1956. The ecology and migrations of sea turtles: 1, Results of field work in Florida, 1955. American Museum novitates; no. 1793.
- Carroll AG, Prezeslawski R, Duncan A, Gunning B. 2017. A critical review of the potential impacts of marine seismic surveys on fish and invertebrates. *Marine Pollution Bulletin*. 114(1):9–24. <https://www.sciencedirect.com/science/article/pii/S0025326X16309584?via%3Dihub>. doi:10.1016/j.marpolbul.2016.11.038.
- Castellote M, Clark CW, Lammers MO. 2012. Acoustic and behavioural changes by fin whales (*Balaenoptera physalus*) in response to shipping and airgun noise. *Biological Conservation*. 147(1):115–122.
- Cholewiak D, DeAngelis AI, Palka D, Corkeron PJ, Van Parijs SM. 2017. Beaked whales demonstrate a marked acoustic response to the use of shipboard echosounders. *Royal Society Open Science*. 4(12):170940. <https://doi.org/10.1098/rsos.170940>.
- Chorney NE, Warner G, MacDonnell J, McCrodan A, Deveau T, McPherson C, O'Neill C, Hannay D, Rideout B. 2011. Underwater Sound Measurements. Anchorage, AK: LGL Alaska Research Associates Inc.
- Colden A, Lipcius R. 2015. Lethal and Sublethal Effects of Sediment Burial on the Eastern Oyster, *Crassostrea virginica*. *Marine Ecology Progress Series*. 527:105-117.
- Collette BB, Klein-MacPhee GK, editors. 2002. Bigelow and Schroeder's Fishes of the Gulf of Maine. 3rd ed. Smithsonian Institution Press. 748 p.
- Collie JS, Hermesen JM, Valentine PC, Almeida FP. 2005. Effects of fishing on gravel habitats: assessment and recovery of benthic megafauna on Georges Bank. *American Fisheries Society Symposium*. 41:325–343.
- Conn PB, Silber GK. 2013. Vessel speed restrictions reduce risk of collision mortality for North Atlantic right whales. *Ecosphere*. 4(4):1–16.
- Cooke JG. 2020. *Eubalaena glacialis* (errata version published in 2020): The IUCN Red List of Threatened Species 2020: e.T41712A178589687. [accessed 19 November 2022]. <https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T41712A178589687.en>.
- Crocker SE, Fratantonio FD. 2016. Characteristics of Sounds Emitted During High-Resolution Marine Geophysical Surveys. Newport, RI: Naval Undersea Warfare Center Division. OCS Study BOEM 2016-044, NUWC-NPT Technical Report 12,203. <https://espis.boem.gov/final%20reports/5551.pdf>.
- Curtice C, Cleary J, Shumchenia E, Halpin PN. 2019. Marine-life Data and Analysis Team (MDAT) Technical Report on the Methods and Development of Marine-life Data to Support Regional Ocean Planning and Management. Prepared on behalf of the Marine-life Data and Analysis Team (MDAT). 81 p. <http://seamap.env.duke.edu/models/mdat/MDAT-Technical-Report.pdf>.

- Davis GE, Baumgartner MF, Bonnell JM, Bell J, Berchok C, Thornton JB, Brault S, Buchanan G, Charif RA, Cholewiak D, Clark CW. 2017. Long-term passive acoustic recordings track the changing distribution of North Atlantic right whales (*Eubalaena glacialis*) from 2004 to 2014. *Scientific Reports*. 7:13460. <https://doi.org/10.1038/s41598-017-13359-3>.
- Deep Sea Coral Research and Technology Program. 2016. Observations of Deep-Sea Coral and Sponge Occurrences from the NOAA National Deep-Sea Coral and Sponge Database, 1842-present. NOAA National Centers for Environmental Information. NCEI Accession 0145037. [accessed 2023 Jul 7]. <https://www.ncei.noaa.gov/archive/accession/0145037>.
- Degrear S, Carey DA, Coolen JWP, Hutchison ZL, Kerchof F, Rumes B, Vanaverbeke J. 2020. Offshore Wind Farm Artificial Reef Affect Ecosystem Structure and Functioning A Synthesis. *Oceanography*. 33(4):48–57.
- Dernie KM, Kaiser MJ, Warwick RM. 2003. Recovery rates of benthic communities following physical disturbance. *Journal of Animals Ecology*. 72:1043–1056. <https://doi.org/10.1046/j.1365-2656.2003.00775.x>.
- Dobbs KM. 2017. 2016 Seafloor sediment analysis and mapping: Mid-coast Maine. Augusta, ME: Maine Coastal Program. 115 p. [accessed May 31, 2023]. https://www.maine.gov/dmr/sites/maine.gov.dmr/files/docs/MCMI_2016_SedimentAnalysisReport_final_revised.pdf.
- Dowling Z, Sievert PR, Baldwin E, Johnson L, von Oettingen S, Reichard J. 2017. Flight Activity and Offshore Movements of Nano-Tagged Bats on Martha’s Vineyard, MA. Sterling, VA: U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. 39 p. OCS Study BOEM 2017-054.
- East Coast Aquatics. 2011. Gulf of Maine Ecosystem Overview. 221 p. Canadian Technical Report of Fisheries and Aquatics Sciences 2946.
- Eckert KL, Wallace BP, Frazier JG, Eckert SA. 2012. Synopsis of the Biological Data on the Leatherback Sea Turtle (*Dermochelys coriacea*). U.S. Fish and Wildlife Service Biological Technical Publication BTP-R4015-2012.
- Erbe C, Marley SA, Schoeman RP, Smith JN, Trigg LE, Embling CB. 2019. The Effects of Ship Noise on Marine Mammals – A Review. *Frontiers in Marine Science*. 6:606. doi:10.3389/fmars.2019.00606.
- Essink K. 1999. Ecological effects of dumping of dredged sediments; options for management. *Journal of Coastal Conservation*. 5:69-80.
- Federal Communications Commission (FCC). 2021. Public Notice: Actions Taken Under Cable Landing License Act. Report No. SCL-00313. https://licensing.fcc.gov/ibfsweb/ib.page.FetchPN?report_key=5806319.

- Federal Office of Civil Aviation (FOCA). 2007. Schadstoffemissionen von Flugzeug-Kolbenmotoren Zusammenfassender Bericht (Pollutant Emissions from Aircraft Piston Engines Summary Report). <https://www.bazl.admin.ch/bazl/de/home/themen/umwelt/schadstoffe/triebwerkemissionen/zusammenfassender-bericht--anhaenge-und-datenblaetter.html>.
- Filiciotto F, Vazzana M, Celi M, Maccarrone V, Ceraulo M, Buffa G, Di Stefano V, Mazzola S, Buscaino G. 2014. Behavioural and biochemical stress responses of *Palinurus elephas* after exposure to boat noise pollution in tank. *Marine Pollution Bulletin*. 84(1–2):104–114. <https://doi.org/10.1016/j.marpolbul.2014.05.029>.
- Finley KJ, Miller GW, Davis RA, Greene CR. 1990. Reactions of belugas, *Delphinapterus leucas* and narwhals, *Monodon monoceros*, to ice-breaking ships in the Canadian high Arctic. *Canadian Bulletin of Fisheries and Aquatic Sciences*. 224:97–117.
- Finneran JJ, Henderson EE, Houser DS, Jenkins K, Kotecki S, Mulsow J. 2017. Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III). Technical report by Space and Naval Warfare Systems Center Pacific (SSC Pacific). 183 p.
- Firth L, Knights A, Bridger D, Evans A, Mieszkowska N, Moore P, O'Connor N, Sheehand E, Thompson R, Hawkins S. 2016. Ocean sprawl: challenges and opportunities for biodiversity management in a changing world. *Oceanography and marine biology*. 54:189-262.
- Fitzgerald D. 2021. Maine Scallop Aquaculture Report. Gulf of Maine Research Institute. [accessed May 31, 2023]. https://gmri-org-production.s3.amazonaws.com/documents/Scallop_Aquaculture_Report_1.pdf.
- Fountain CT, Waller RG, Auster PJ. 2019. Individual and population level variation in the reproductive potential of deep-sea corals from different regions within the Gulf of Maine. *Frontiers in Marine Science*. 6. doi:10.3389/fmars.2019.00172.
- Garcia SM, Zerbi A, Aliaume C, Do Chi T, Lasserre G. 2003. The ecosystem approach to fisheries: Issues, terminology, principles, institutional foundations, implementation and outlook. Rome: FAO. 71 p. FAO Fisheries Technical Paper No. 443.
- Greater Atlantic Regional Fisheries Office. 2020. Section 7: Consultation technical guidance in the greater Atlantic region. NOAA Fisheries. [accessed October 25 2022]. <https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-consultation-technical-guidance-greater-atlantic>.
- Greene JK, Anderson MG, Odell J, Steinberg N. 2010. The Northwest Atlantic Marine Ecoregional Assessment: Species, Habitats and Ecosystems. Phase One. Boston, MA: The Nature Conservancy, Eastern U.S. Division. 460 p. [accessed 2023 Jul 6]. <https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/edc/Documents/namera-phase1-fullreport.pdf>.
- Griffin LP, Griffin CR, Finn JT, Prescott RL, Faherty M, Still BM, Danylchuk AJ. 2019. Warming seas increase cold-stunning events for Kemp's ridley sea turtles in the northwest Atlantic. *PLOS ONE*. 14(1):e0211503. <https://doi.org/10.1371/journal.pone.0211503>.

- Guerra M, Dawson SM, Brough TE, Rayment WJ. 2014. Effects of boats on the surface and acoustic behaviour of an endangered population of bottlenose dolphins. *Endangered Species Research*. 24:221–236. <https://www.int-res.com/articles/esr2014/24/n024p221.pdf>. doi:10.3354/esr00598.
- Gulf of Maine Council on the Marine Environment. 2013. Commercial Fisheries: State of the Gulf of Maine Report. <http://www.gulfofmaine.org/2/wp-content/uploads/2014/03/commercial-fisheries-theme-paper-webversion.pdf>.
- Gulf of Maine Research Institute. 2023. Gulf of Maine Warming Update: 2022 the Second-Hottest Year on Record. [accessed May 30, 2023]. <https://www.gmri.org/stories/warming-22/>.
- Gulland FMD, Baker JD, Howe M, LaBrecque W, Leach L, Moore SE, Reeves RR, Thomas PO. 2022. A review of climate change effects on marine mammals in United States waters: Past predictions, observed impacts, current research and conservation imperatives. *Climate Change Ecology*. 3. <https://doi.org/10.1016/j.ecochg.2022.100054>.
- Gustavson K. 2011. Coastal Ecosystems and Habitats State of The Gulf of Maine Report. Gulf of Maine Council on the Marine Environment. [accessed 13 May 2023]. <http://www.gulfofmaine.org/2/wp-content/uploads/2014/03/coastal-ecosystems-and-habitats.pdf>.
- Hall AJ, McConnell BJ, Schwacke LH, Ylitalo GM, Williams R, Rowles TK. 2018. Predicting the effects of polychlorinated biphenyls on cetacean populations through impacts on immunity and calf survival. *Environmental Pollution*. 233:407–418. <https://core.ac.uk/download/161932208.pdf>.
- Harding S, Cousins N. 2022. Review of the Impacts of Anthropogenic Underwater Noise on Marine Biodiversity and Approaches to Manage and Mitigate them. Montreal: Secretariat of the Convention on Biological Diversity. Technical Series No. 99.
- Hare J, Blythe B, Ford K, Godfrey-McKee S, Hooker B, Jensen B, Lipsky A, Nachman C, Pfeiffer L, Rasser M, Renshaw K. 2022. NOAA Fisheries and BOEM Federal Survey Mitigation Strategy – Northeast U.S. Region. NOAA Technical Memorandum NMFS-NE-292. <https://www.fisheries.noaa.gov/resource/document/federal-survey-mitigation-strategy-northeast-us-region>.
- Hare JA, Morrison WE, Nelson MW, Satachura MM, Teeters EJ, Griffis RB, Alexander MA, Scott JD, Alade L, Bell RJ, Chute AS, Curti KL, Curtis TH, Kircheis D, Kocik JF, Lucky SM, McCandless CT, Milke LM, Richardson DE, Robillard E, Walsh HJ, McManus MC, Marancik KE, Griswold CA. 2016. A vulnerability assessment of fish and invertebrates to climate change on the northeast U.S. continental shelf. *PLOS ONE*. 11(2):e0146756. <https://doi.org/10.1371/journal.pone.0146756>.
- Hatch SK, Connelly EE, Divoll TJ, Stenhouse IJ, Williams KA. 2013. Offshore Observations of Eastern Red Bats (*Lasiurus borealis*) in the Mid-Atlantic United States using Multiple Survey Methods. *PLOS ONE*. 8:e83803.

- Hayes SA, Josephson E, Maze-Foley K, Rosel PE. 2019. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments – 2018. Woods Hole, MA: U.S. Department of Commerce, National Fisheries Science Center. 298 p. NOAA Technical Memorandum NMFS-NE-258. <https://repository.library.noaa.gov/view/noaa/20611>.
- Hayes SA, Josephson E, Maze-Foley K, Rosel PE. 2020. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments – 2019. Woods Hole, MA: U.S. Department of Commerce, National Fisheries Science Center. 479 p. NOAA Technical Memorandum NMFS-NE 264. https://media.fisheries.noaa.gov/dam-migration/2019_sars_atlantic_508.pdf.
- Hayes SA, Josephson E, Maze-Foley K, Rosel PE, McCordic J, Wallace JE. 2023. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessment Reports 2022. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center. 262 p. NOAA Technical Memorandum NMFS-NE-304.
- Hayes SA, Josephson E, Maze-Foley K, Rosel PE, Turek J. 2021. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments – 2020. Woods Hole, MA: U.S. Department of Commerce, National Fisheries Science Center. NOAA Technical Memorandum NMFS-NE 271. <https://repository.library.noaa.gov/view/noaa/32072>.
- Hayes SA, Josephson E, Maze-Foley K, Rosel PE, Wallace J. 2022. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments – 2021. 386 p. <https://media.fisheries.noaa.gov/2022-08/U.S.%20Atlantic%20and%20Gulf%20of%20Mexico%202021%20Stock%20Assessment%20Report.pdf>.
- Hazel J, Lawler IR, Marsh H, Robson S. 2007. Vessel speed increases collision risk for the green turtle *Chelonia mydas*. *Endangered Species Research*. 3(2):105–113. <http://dx.doi.org/10.3354/esr003105>.
- Hendrick VJ, Hutchison ZL, Last KS. 2016. Sediment Burial Intolerance of Marine Macroinvertebrates. *PLOS ONE*. 11(2):e0149114.
- Hill AN, Karniski C, Robbins J, Pitchford T, Todd S, Asmutis-Silvia R. 2017. Vessel collision injuries on live humpback whales, *Megaptera novaeangliae*, in the southern Gulf of Maine. *Marine Mammal Science*. 33(2):558–573. <https://doi.org/10.1111/mms.12386>.
- Hodge BC, Pendleton DE, Ganley LC, O'Brien O, Kraus SD, Quintana-Rizzo E, Redfern JV. 2022. Identifying predictors of species diversity to guide designation of marine protected areas. *Conservation Science and Practice*. 4(5):e12665. <https://doi.org/10.1111/csp2.12665>.
- Hogan F, Hooker B, Jensen B, Johnston L, Lipsky A, Methratta E, Silva A, Hawkins A. 2023. Fisheries and offshore wind interactions: synthesis of science. Woods Hole, MA: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center. 388 p. NOAA Technical Memorandum NMFS-NE-291. [accessed 2023 Jun 12].

- Holt MM, Noren DP, Veirs V, Emmons CK, Veirs S. 2009. Speaking up: Killer whales (*Orcinus orca*) increase their call amplitude in response to vessel noise. *The Journal of the Acoustical Society of America*. 125(1):EL27-EL32.
<https://pubs.aip.org/asa/jasa/article/125/1/EL27/1058897/Speaking-up-Killer-whales-Orcinus-orca-increase>. doi:10.1121/1.3040028.
- Holt MM, Tennessen JB, Hanson MB, Emmons CK, Giles DA, Hogan JT, Ford MJ. 2021. Vessels and their sounds reduce prey capture effort by endangered killer whales (*Orcinus orca*). *Marine Environmental Research*. 170:105429.
<https://www.sciencedirect.com/science/article/pii/S0141113621001859?via%3Dihub>. doi:10.1016/j.marenvres.2021.105429.
- Hourigan TF, Etnoyer PJ, McGuinn RP, Whitmire CE, Dorfman DS, Dornback M, Cross SL, Sallis DE. 2015. An introduction to NOAA's national database for deep-sea corals and sponges. Silver Spring, MD: National Oceanic and Atmospheric Administration. 27 p. NOAA Technical Memorandum NOS NCCOS 191. [accessed 2023 Jul 7]. <http://doi.org/10.7289/V5/TM-NOS-NCCOS-191>.
- Hudson DM, Krumholz JS, Pochtar DL, Dickenson NC, Dossot G, Phillips G, Baker EP, Moll TE. 2022. Potential impacts from simulated vessel noise and sonar on commercially important invertebrates. *PeerJ*. 10:e12841. <https://doi.org/10.7717/peerj.12841>.
- Incze L, Ellis SL, Lawton P, Ryan S. 2010. Biodiversity Matters in the Gulf of Maine - summary brochure for International Census of Marine Life. [accessed 13 May 2023].
https://www.researchgate.net/publication/309120968_Biodiversity_Matters_in_the_Gulf_of_Maine_-_summary_brochure_for_international_Census_of_Marine_Life.
- Intergovernmental Panel on Climate Change (IPCC). 2018. Global Warming of 1.5°C. Contribution of Working Group I, II, and III (Summary for Policy Makers). [accessed May 24, 2023].
https://www.ipcc.ch/site/assets/uploads/sites/2/2022/06/SPM_version_report_LR.pdf.
- James M, Davenport J, Hays G. 2006. Expanded thermal niche for a diving vertebrate: A leatherback turtle diving into near-freezing water. *Journal of Experimental Marine Biology and Ecology*. 335:221–226.
<https://www.sciencedirect.com/science/article/abs/pii/S0022098106001663?via%3Dihub>. doi:10.1016/j.jembe.2006.03.013.
- Jensen AS, Silber GK, Calambokidis J. 2003. Large whale ship strike database. Silver Spring, MD: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. 37 p. Technical Memorandum NMFS-OPR-25. [accessed 2023 Jun 11].
<https://repository.library.noaa.gov/view/noaa/23127>.
- Jepson PD, Deaville R, Barber JL, Aguilar À, Borrell A, Murphy S, Barry J, Brownlow A, Barnett J, Berrow S, Cunningham AA. 2016. PCB pollution continues to impact populations of orcas and other dolphins in European waters. *Scientific Reports*. 6(1):18573. <https://doi.org/10.1038/srep18573>.
- Johnson A, Salvador G, Kenney J, Robbins J, Kraus S, Landry S, Clapham P. 2005. Fishing Gear Involved in Entanglement of Right and Humpback Whales. *Marine Mammal Science*. 21(4):635–645.
https://bycatch.org/sites/default/files/Johnson_etal_2005_0.pdf. doi:10.1111/j.1748-7692.2005.tb01256.x.

- Jumars PA, Dorgan KM, Lindsay SM. 2015. Diet of worms emended: an update of polychaete feeding guilds. *Annual review of marine science*. 7:497-520.
- Kaiser M, Collie J, Hall S, Jennings S, Poiner I. 2002. Modification of marine habitats by trawling activities: prognosis and solutions. *Fish and Fisheries*. 3:114–136. <https://doi.org/10.1046/j.1467-2979.2002.00079.x>.
- Kaiser MJ, Clarke KR, Hinz H, Austen MCV, Somerfield PJ, Karakassis I. 2006. Global analysis of response and recovery of benthic biota to fishing. *Marine Ecology Progress Series*. 311:1–14. <https://www.int-res.com/articles/feature/m311p001.pdf>. doi:10.3354/meps311001.
- Kates Varghese H, Miksis-Olds J, DiMarzio N, Lowell K, Linder E, Mayer LA, D M. 2020. The effect of two 12 kHz multibeam mapping surveys on the foraging behavior of Cuvier’s beaked whales off of Southern California. *Journal of the Acoustical Society of America*. 147(6):3849–3858. <https://pubs.aip.org/asa/jasa/article/147/6/3849/963210/The-effect-of-two-12-kHz-multibeam-mapping-surveys>. doi:10.1121/10.0001385.
- Kelley DE, Vlasic JP, Brilliant SW. 2020. Assessing the lethality of ship strikes on whales using simple biophysical models. *Marine Mammal Science*. 37(1):251–267. <https://doi.org/10.1111/mms.12745>.
- King K, Joblon M, McNally K, Clayton L, Pettis H, Corkeron P, Nutter F. 2021. Assessing North Atlantic Right Whale (*Eubalaena glacialis*) Welfare. *Journal of Zoological and Botanical Gardens*. 2(4):728–739. <https://doi.org/10.3390/jzbg2040052>.
- Kipple BM, Gabriele CM. 2003. Glacier Bay Watercraft Noise. Prepared by Naval Surface Warfare Center – Carderock Division for Glacier Bay National Park and Preserve. Document Number NSWCCD-71-TR-2003/522. <https://www.nps.gov/glba/learn/nature/upload/GBWatercraftNoiseRpt.pdf>.
- Kipple BM, Gabriele CM. 2004. Glacier Bay watercraft noise – noise characterization for tour, charter, private, and government vessels: Report to Glacier Bay National Park by the Naval Surface Warfare Cent-Detachment Bremerton. Technical Report NSWCCD-71-TR-2004/545.
- Kite-Powell HL, Knowlton A, Brown M. 2007. Modeling the Effect of Vessel Speed on Right Whale Ship Strike Risk. Report by New England Aquarium Edgerton Research Laboratory. Report No. NA04NMF47202394. https://www.whoi.edu/cms/files/ship_strike_risk_and_vessel_speed_final_report_Apr_07_24304.pdf.
- Klein JI, Harris MD, Tankersley WM, Meyer R, Smith GC, Chadwick WJ. 2012. Evaluation of visual impact on cultural resources/historic properties: North Atlantic, Mid-Atlantic, South Atlantic, and Florida Straits. New Orleans, LA: U.S. Department of the Interior, Bureau of Ocean Energy Management. 726 p. Report No.: OCS Study BOEM 2012-006.
- Knowlton AR, Hamilton PK, Marx MK, Pettis HP, Kraus SD. 2012. Monitoring North Atlantic right whale *Eubalaena glacialis* entanglement rates: A 30 yr retrospective. *Marine Ecology Progress Series*. 466:293–302. https://www.int-res.com/articles/meps_oa/m466p293.pdf. doi:10.3354/meps09923.

- Kraus SD, Brown MW, Caswell H, Clark CW, Fujiwara M, Hamilton PK, M. RR. 2005. North Atlantic right whales in crisis. *Science*. 309(5734):561–562. doi:10.1126/science.1111200.
- Kritzer J, Delucia MB, Greene E, Shumway C, Topolski M, Thomas-Blate J, Chiarella L, Davy K, Smith K. 2016. The Importance of Benthic Habitats for Coastal Fisheries. *BioScience*. 66(4):274–284. <https://doi.org/10.1093/biosci/biw014>.
- LaBrecque E, Curtice C, Harrison J, Van Parijs SM, Halpin PN. 2015. Biologically important areas for cetaceans within U.S. waters. *Aquatic Mammals*. 41(1):17–29. https://www.researchgate.net/profile/Erin-Labrecque/publication/273003941_Biologically_Important_Areas_for_Cetaceans_Within_US_Waters_-_East_Coast_Region/links/54f753560cf28d6dec9e79bf/Biologically-Important-Areas-for-Cetaceans-Within-US-Waters-East-Coast-Region.pdf.
- Laist DW, Knowlton AR, Mead JG, Collet AS, Podesta M. 2001. Collisions between ships and whales. *Marine Mammal Science*. 17(1):35–75. <https://www.mmc.gov/wp-content/uploads/shipstrike.pdf>. doi:10.1111/j.1748-7692.2001.tb00980.x.
- Lapointe G. 2013. Commercial Fisheries State of the Gulf of Maine Report. Gulf of Maine Council on the Marine Environment. [accessed 13 May 2023]. <http://www.gulfofmaine.org/2/wp-content/uploads/2014/03/commercial-fisheries-theme-paper-webversion.pdf>.
- Lenhardt M. 1994. Seismic and very low frequency sound induced behaviors in captive loggerhead marine sea turtles (*Caretta caretta*). In: Fourteenth Annual Symposium on Sea Turtle Biology and Conservation; Hilton Head, SC. 238–241 p.
- Lesage V, Barrette C, Kingsley MCS, Sjare B. 1999. The effect of vessel noise on the vocal behavior of belugas in the St. Lawrence River estuary, Canada. *Marine Mammal Science*. 15(1):65–84. doi:10.1111/j.1748-7692.1999.tb00782.x.
- Lesage V, Gavrilchuk K, Andrews RD, Sears R. 2017. Foraging areas, migratory movements and winter destinations of blue whales from the western North Atlantic. *Endangered Species Research*. 34:27–43. <https://www.int-res.com/articles/esr2017/34/n034p027.pdf>. doi:10.3354/esr00838.
- Lesage V, Gosselin J-F, Lawson JW, McQuinn I, Moors-Murphy H, Pourde S, Sears R, Simard Y. 2018. Habits important to blue whales (*Balaenoptera musculus*) in the western North Atlantic. Canadian Science Advisory Secretariat (CSAS) Research Document 2016/080. <https://waves-vagues.dfo-mpo.gc.ca/library-bibliotheque/40681373.pdf>.
- Lindholm J, Auster P, Valentine P. 2004. Role of a large marine protected area for conserving landscape attributes of sand habitats on Georges Bank (NW Atlantic). *Marine Ecology Progress Series*. 269:61–68.
- Lockhart F, Estrella B. 1997. Amendment 3 to the interstate fishery management plan for American lobster. Atlantic States Marine Fisheries Commission. [accessed 2023 Jun 11]. <https://www.asmfc.org/uploads/file/lobsterAmendment3.pdf>.

- Lokkeborg S, Ona E, Vold A, Salthaug A. 2012. Sounds from seismic air guns: gear- and species-specific effects on catch rates and fish distribution. *Canadian Journal of Fisheries and Aquatic Sciences*. 69(8):1278–1291. [accessed 08/01; 2014/02]. <http://dx.doi.org/10.1139/f2012-059>. doi:10.1139/f2012-059.
- Love M, Baldera A, Young C, Robbins C. 2013. *The Gulf of Mexico Ecosystem: A Coastal and Marine Atlas*. New Orleans, LA: Ocean Conservancy, Gulf Restoration Center. 232 p. [accessed January 27, 2023]. <https://oceanconservancy.org/wp-content/uploads/2017/05/gulf-atlas.pdf>.
- Maine Department of Environmental Protection. 2022. 2018/2020/2022 Integrated water quality monitoring and assessment report. Augusta, ME: Maine Department of Environmental Protection, Bureau of Water Quality, Division of Environmental Assessment. [accessed 2023 Jun 1]. [https://www.maine.gov/dep/water/monitoring/305b/2022/25-May-2022_2018-22_ME_IntegratedRpt-REPORT%20\(002\).pdf](https://www.maine.gov/dep/water/monitoring/305b/2022/25-May-2022_2018-22_ME_IntegratedRpt-REPORT%20(002).pdf).
- Maine Department of Environmental Protection. 2023. Maine statutory water classification. Augusta, ME: Maine Department of Environmental Protection, Bureau of Water Quality, Division of Environmental Assessment. [accessed 2023 May 31]. <https://maine.maps.arcgis.com/apps/webappviewer/index.html?id=397738f1d21d42589ab7ac989e2db568>.
- Maine Department of Inland Fisheries and Wildlife. 2015. Maine’s wildlife action plan. Augusta, ME: Maine Department of Inland Fisheries and Wildlife. 382 p. [accessed 2023 May 23]. https://www.maine.gov/IFW/docs/2015%20ME%20WAP%20All_DRAFT.pdf.
- Maine Department of Inland Fisheries and Wildlife. 2023. Shorebirds. [accessed May 22 2023]. <https://www.maine.gov/ifw/fish-wildlife/wildlife/species-information/birds/shorebirds.html>.
- Maine Department of Marine Resources (DMR). 2022. Large Whale Species of New England. [accessed May 31 2023]. <https://www.maine.gov/dmr/science/species-information/protected-species-in-the-gulf-of-maine/large-whale-species-of-new-england>.
- Maine Department of Marine Resources (DMR). 2023a. Maine Research Array Baseline Surveys Summary. 4 p.
- Maine Department of Marine Resources (DMR). 2023b. Maine’s Saltwater For-Hire Fleet Listing. [accessed 17 May 2023]. <https://www.maine.gov/dmr/fisheries/recreational/charter-head-boats-for-hire>.
- Maine Department of Marine Resources (DMR). 2023c. Where to Fish Along Maine’s Coast. [accessed 17 May 2023]. <https://www.maine.gov/dmr/fisheries/recreational/anglers-guide/where-to-fish>.
- Malek A, Collie J, Taylor D. 2016. Trophic structure of a coastal fish community determined with diet and stable isotope analyses. *Journal of Fish Biology*. 89:1513–1536. doi:10.0000/jfb.13059.
- Marine Geospatial Ecology Laboratory (MGEL). 2022. Habitat-based Marine Mammal Density Models for the U.S. Atlantic: Latest Versions. Duke University. [accessed May 30, 2023]. <https://seamap.env.duke.edu/models/Duke/EC/>.

- Mayo CA, Letcher BH, Scott S. 2001. Zooplankton filtering efficiency of the baleen of a North Atlantic right whale, *Eubalaena glacialis*. The Journal of Cetacean Research and Management Special Issue. 2:225–229. <https://journal.iwc.int/index.php/jcrm/article/view/286/53>. doi:10.47536/jcrm.vi.286.
- McConnaughey RA, Hiddink JG, Jennings S, Pitcher CR, Kaiser MJ, Suuronen P, Sciberras M, Rijnsdorp AD, Collie JS, Mazor T, Amoroso RO, Parma AM, Hilborn R. 2020. Choosing best practices for managing impacts of trawl fishing on seabed habitats and biota. *Fish and Fisheries*. 21(2):319–337.
- McKenna MF, Ross D, Wiggins SM, Hildebrand JA. 2012. Underwater radiated noise from modern commercial ships. *Journal of the Acoustical Society of America*. 131(1):92–103. <https://doi.org/10.1121/1.3664100>.
- McLeod KL, Lubchenco J, Palumbi SR, Rosenberg AA. 2005. Scientific Consensus Statement on Marine Ecosystem-Based Management. <https://marineplanning.org/wp-content/uploads/2015/07/Consensusstatement.pdf>.
- Mickle MF, Higgs DM. 2022. Towards a new understanding of elasmobranch hearing. *Marine Biology*. 169(1).
- Mid-Atlantic Fishery Management Council. 2017. Unmanaged Forage Omnibus Amendment. Dover, DE: 223 p. [accessed 2023 Jul 6]. https://static1.squarespace.com/static/511cdc7fe4b00307a2628ac6/t/5a0b49b053450ab00cbe4e46/1510689203283/20170613_Final%2BForage%2BEA_FONSI%2BSigned.pdf.
- Mikkelsen L, Johnson M, Wisniewska DM, van Neer A, Siebert U, Madsen PT, Teilmann J. 2019. Long-term sound and movement recording tags to study natural behavior and reaction to ship noise of seals. *Ecology and Evolution*. 9(5):2588–2601. <https://doi.org/10.1002/ece3.4923>.
- Mills KE, Pershing AJ, Brown CJ, Chen Y, Chiang F-S, Holland DS, Lehuta S, Nye JA, Sun JC, Thomas AC. 2013. Fisheries management in a changing climate: lessons from the 2012 ocean heat wave in the Northwest Atlantic. *Oceanography*. 26(2):191–195.
- 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. 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>.
- Murphy KA, Davies H, Shafer H, Cox K, Nikolich K, Juanes F. 2020. Impacts of noise on the behavior and physiology of marine invertebrates: A metaanalysis. In: *Proceedings of Meetings on Acoustics*;
- Murphy S, Law RJ, Deaville R, Barnett J, Perkins MW, Brownlow A, Penrose R, Davison NJ, Barber JL, Jepson PD. 2018. Organochlorine contaminants and reproductive implication in cetaceans: a case study of the common dolphin. In: Fossi MC, Panti C, editors. *Marine Mammal Ecotoxicology*. Academic Press.

- Musick JA, Limpus CJ. 1996. Habitat Utilization and Migration in Juvenile Sea Turtles. In: Lutz PL, Musick JA, editors. *The Biology of Sea Turtles*. New York, NY: CRC Press. p. 137–163.
- National Aeronautics and Space Administration (NASA). 2023. The Effects of Climate Change. [accessed April 5 2023]. <https://climate.nasa.gov/effects/>.
- National Marine Fisheries Service (NMFS). 2016. Ecosystem-Based Fisheries Management Policy of the National Marine Fisheries Service. Silver Spring, MD: NMFS Policy 01-120. <https://media.fisheries.noaa.gov/dam-migration/01-120.pdf>.
- National Marine Fisheries Service (NMFS). 2021. Cold-Stunning and Sea Turtles. [accessed May 30 2023]. <https://www.fisheries.noaa.gov/national/marine-life-distress/cold-stunning-and-sea-turtles-frequently-asked-questions>.
- National Marine Fisheries Service (NMFS). 2022a. 2018–2020 Pinniped Unusual Mortality Event Along the Northeast Coast. <https://www.fisheries.noaa.gov/new-england-mid-atlantic/marine-life-distress/2018-2020-pinniped-unusual-mortality-event-along>.
- National Marine Fisheries Service (NMFS). 2022b. Descriptions of selected fishery landings and estimates of recreational party and charter vessel revenue from areas: a planning-level assessment. Gulf of Maine RFI. [official communication; letter from National Oceanic and Atmospheric Administration on 2022 Oct 3].
- National Marine Fisheries Service (NMFS). 2022c. Green turtle (*Chelonia mydas*) Species Page. [accessed May 30 2023]. <https://www.fisheries.noaa.gov/species/green-turtle>.
- National Marine Fisheries Service (NMFS). 2023a. 2016–2023 Humpback Whale Unusual Mortality Event Along the Atlantic Coast. [accessed August 31 2023]. <https://www.fisheries.noaa.gov/national/marine-life-distress/2016-2023-humpback-whale-unusual-mortality-event-along-atlantic-coast>.
- National Marine Fisheries Service (NMFS). 2023b. 2017–2023 Minke Whale Unusual Mortality Event along the Atlantic Coast. [accessed August 31 2023]. <https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2023-minke-whale-unusual-mortality-event-along-atlantic-coast>.
- National Marine Fisheries Service (NMFS). 2023c. 2017–2023 North Atlantic Right Whale Unusual Mortality Event. [accessed August 31 2023]. <https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2023-north-atlantic-right-whale-unusual-mortality-event>.
- National Marine Fisheries Service (NMFS). 2023d. 2022–2023 Pinniped Unusual Mortality Event along the Maine Coast. [accessed August 31 2023]. <https://www.fisheries.noaa.gov/marine-life-distress/2022-2023-pinniped-unusual-mortality-event-along-maine-coast>.
- National Marine Fisheries Service (NMFS). 2023e. Draft U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessment Reports 2022. Woods Hole, MA: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. 147 p.

- National Marine Fisheries Service (NMFS). 2023f. North Atlantic Right Whale Calving Season 2023. [accessed August 31 2023]. <https://www.fisheries.noaa.gov/national/endangered-species-conservation/north-atlantic-right-whale-calving-season-2023>.
- National Marine Fisheries Service (NMFS). 2023g. Sea Turtle Stranding and Salvage Network. [accessed May 30 2023]. <https://www.fisheries.noaa.gov/national/marine-life-distress/sea-turtle-stranding-and-salvage-network>.
- National Marine Fisheries Service (NMFS). 2023h. Section 7 Species Presence Table: Sea Turtles in the Greater Atlantic Region. [accessed May 30 2023]. <https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-species-presence-table-sea-turtles-greater>.
- National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS). 2007. Green Sea Turtle (*Chelonia Mydas*) 5-Year Review: Summary and Evaluation. <https://repository.library.noaa.gov/view/noaa/17044>.
- National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS). 2008. Recovery plan for the northwest Atlantic population of the Loggerhead sea turtle (*Caretta caretta*). <https://repository.library.noaa.gov/view/noaa/3720>.
- National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS). 2015. Kemp's Ridley Sea Turtle (*Lepidochelys kempii*) 5-Year Review: Summary and Evaluation. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service Office of Protected Resources and U.S. Department of the Interior, U.S. Fish and Wildlife Service Southwest Region. 63 p. <https://repository.library.noaa.gov/view/noaa/17048>.
- National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS). 2020. Endangered Species Act status review of the leatherback turtle (*Dermochelys coriacea*) 2020. U.S. National Marine Fisheries Service and U.S. Fish and Wildlife Service. 396 p.
- National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS). 2023. Loggerhead Sea Turtle (*Caretta caretta*) Northwest Atlantic Ocean DPS 5-Year Review: Summary and Evaluation 2023. https://media.fisheries.noaa.gov/2023-03/Signed_5YrReview_NWAtlantic_Loggerhead.pdf.
- National Oceanic and Atmospheric Administration (NOAA). 2020. Economics: National Ocean Watch (ENOW) Data. Based on data from the Bureau of Labor Statistics and the Bureau of Economic Analysis. Charleston, SC: NOAA Office for Coastal Management. <https://coast.noaa.gov/digitalcoast/data/enow.html>.
- National Oceanic and Atmospheric Administration (NOAA). 2021. Final Environmental Impact Statement, Regulatory Impact Review, and Initial Regulatory Flexibility Analysis for Amending the Atlantic Large Whale Take Reduction Plan: Risk Reduction Rule.
- National Oceanic and Atmospheric Administration (NOAA) Fisheries. 2018. Exploring deep-sea corals in Maine story map. [accessed July 7 2023]. <https://www.fisheries.noaa.gov/story-map/learn-about-deep-sea-corals-through-story-maps>.

- National Oceanic and Atmospheric Administration (NOAA) Fisheries. 2021. Office of Science and Technology, Commercial Landings Query. [accessed 05/26/2023]. www.fisheries.noaa.gov/foss.
- National Oceanic and Atmospheric Administration (NOAA) Fisheries. 2022a. Deep-sea coral habitat. [accessed July 6 2023]. <https://www.fisheries.noaa.gov/national/habitat-conservation/deep-sea-coral-habitat>.
- National Oceanic and Atmospheric Administration (NOAA) Fisheries. 2022b. Northeast multispecies closed area regulations: Gulf of Maine. [accessed July 7 2023]. <https://www.fisheries.noaa.gov/new-england-mid-atlantic/commercial-fishing/northeast-multispecies-closed-area-regulations-gulf#gulf-of-maine-cod-protection-closures>.
- National Oceanic and Atmospheric Administration (NOAA) Fisheries. 2022c. Status of Stocks 2022. [accessed 13 May 2023]. <https://www.fisheries.noaa.gov/sustainable-fisheries/status-stocks-2022>.
- National Oceanic and Atmospheric Administration (NOAA) Fisheries. 2023a. Cetacean & Sound Mapping. <https://cetsound.noaa.gov/biologically-important-area-map>.
- National Oceanic and Atmospheric Administration (NOAA) Fisheries. 2023b. Essential Fish Habitat Mapper. [accessed 20 May 2023]. <https://www.habitat.noaa.gov/apps/efhmapper/>.
- National Oceanic and Atmospheric Administration (NOAA) Fisheries. 2023c. Personal communications between J. Tiggelaar and Fisheries Statistics Division regarding 2022 recreational fishing data for Oceans, Maine, New Hampshire, Massachusetts.
- National Oceanic and Atmospheric Administration (NOAA) Fisheries. 2023d. State of the Ecosystem 2023: New England. [accessed May 31, 2023]. https://repository.library.noaa.gov/view/noaa/49706/noaa_49706_DS1.pdf.
- National Science Foundation, U.S. Geological Survey. 2011. Final programmatic environmental impact statement/overseas environmental impact statement for marine seismic research funded by The National Science Foundation or conducted by the U.S. Geological Survey. Arlington, VA: 514 p.
- New England Fishery Management Council (NEFMC). 2017. Omnibus Essential Fish Habitat Amendment 2. Volume 2: EFH and HAPC Designation Alternatives and Environmental Impacts. Newburyport, MA: 143 p. [accessed May 18, 2023]. https://www.habitat.noaa.gov/protection/efh/efhmapper/oa2_efh_hapc.pdf.
- New York State Energy Research and Development Authority (NYSERDA). 2017. New York State offshore wind master plan; analysis of multibeam echo sounder and benthic survey data: Final report. Middletown, RI: New York State Energy Research and Development Authority. 168 p. Report No.: NYSERDA Report 17-25a.
- North American Submarine Cable Association (NASCA). 2020. North East Region Maps. [accessed May 18 2023]. <https://www.n-a-s-c-a.org/cable-maps-all-regions/cable-map-regions-northeast/>.

- Northeast Fisheries Science Center (NEFSC). 2023. Passive Acoustic Cetacean Map, v1.1.4. Woods Hole, MA: National Oceanic and Atmospheric Administration, Northeast Fisheries Science Center. [accessed 2023 May 28]. <https://apps-nefsc.fisheries.noaa.gov/pacm>.
- Northeast Regional Ocean Council. 2009. Northeast ocean data portal. [accessed 2023 May 31]. <https://www.northeastoceandata.org/>.
- Northeast Regional Planning Body. 2016. Northeast Ocean Plan. [accessed May 30, 2023]. https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/NortheastOceanPlan_October2016.pdf.
- Nowacek SM, Wells RS, Solow AR. 2006. Short-term effects of boat traffic on bottlenose dolphins, *Tursiops Truncatus*, in Sarasota Bay, Florida. *Marine Mammal Science*. 17(4):673–688. doi:10.1111/j.1748-7692.2001.tb01292.x.
- O’Hara J, Wilcox JR. 1990. Avoidance responses of loggerhead turtles, *Caretta caretta*, to low frequency sound. *Copeia*. 2:564–567. doi:10.2307/1446362.
- Olsen E, Budgell WP, Head E, Kleivane L, Nottestad L, Prieto R, Silva MA, Skov H, Vikingsson GA, Waring G, Oien N. 2009. First Satellite-Tracked Long-Distance Movement of a Sei Whale (*Balaenoptera Borealis*) in the North Atlantic. *Aquatic Mammals*. 35(3):313–318. doi:10.1578/AM.35.3.2009.313.
- Pace RM. 2021. Revisions and Further Evaluations of the Right Whale Abundance Model: Improvements for Hypothesis Testing. Woods Hole, MA: U.S. Department of Commerce, Northeast Fisheries Science Center. 54 p. NOAA Technical Memorandum NMFS-NE-269. <https://apps-nefsc.fisheries.noaa.gov/rcb/publications/tm269.pdf>.
- Palka D, Aichinger Dias L, Broughton E, Chavez-Rosales S, Cholewiak D, Davis G, DeAngelis A, Garrison L, Haas H, Hatch J, Jech M, Josephson E, Mueller-Brennan L, Orphanides C, Pegg N, Sasso C, Sigourney D, Soldevilla M, Walsh H. 2021. Atlantic Marine Assessment Program for Protected Species: FY15 – FY19. U.S. Department of the Interior, Bureau of Ocean Energy Management. 330 p. OCS Study BOEM 2021-051. https://espis.boem.gov/Final%20reports/BOEM_2021-051.pdf.
- Palka DL, Chavez-Rosales S, Josephson E, Cholewiak D, Haas HL, Garrison L, Jones M, Sigourney D, Waring G, Jech M, Broughton E, Soldevilla M, Davis G, DeAngelis A, Sasso CR, Winton MV, Smolowitz RJ, Fay G, LaBrecque E, Leiness JB, Dettloff K, Warden M, Murray K, Orphanides C. 2017. Atlantic Marine Assessment Program for Protected Species: 2010–2014. Washington, D.C.: U.S. Department of the Interior, Bureau of Ocean Energy Management, Atlantic OCS Region. OCS Study BOEM 2017-071. <https://espis.boem.gov/final%20reports/5638.pdf>.
- Parsons MJG, Erbe C, Meekan MG, Parsons SK. 2021. A Review and Meta-Analysis of Underwater Noise Radiated by Small (<25 m Length) Vessels. *Journal of Marine Science and Engineering*. 9(8):827. <https://doi.org/10.3390/jmse9080827>.
- Patrício AR, Varela MR, Barbosa C, Broderick AC, Catry P, Hawkes LA, Regalla A, Godley BJ. 2019. Climate change resilience of a globally important sea turtle nesting population. *Global Change Biology*. 25(2):522–535. <https://doi.org/10.1111/gcb.14520>.

- Pearson WH, Skalski JR, Malme CI. 1992. Effects of sounds from a geophysical survey device on behavior of captive rockfish (*Sebastes* spp.). *Canadian Journal of Fisheries and Aquatic Sciences*. 49:1343–1356. <https://doi.org/10.1139/f92-150>.
- Pedreschi D, Bouch P, Moriarty M, Nixon E, Knights AM, G. RD. 2019. Integrated ecosystem analysis in Irish waters; Providing the context for ecosystem-based fisheries management. *Fisheries Research*. 209:218–229. <https://doi.org/10.1016/j.fishres.2018.09.023>.
- Pelletier SK, Omland K, Watrous KS, Peterson TS. 2013. Information Synthesis on the Potential for Bat Interactions with Offshore Wind Facilities—Final Report. U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM No. 2013-01163. [accessed March 2024]. https://tethys.pnnl.gov/sites/default/files/publications/BOEM_Bat_Wind_2013.pdf.
- Pendleton DE, Sullivan PJ, Brown MW, Cole TV, Good CP, Mayo CA, Monger BC, Phillips S, Record NR, Pershing AJ. 2012. Weekly predictions of North Atlantic right whale *Eubalaena glacialis* habitat reveal influence of prey abundance and seasonality of habitat preferences. *Endangered Species Research*. 18(2):147–161. https://www.int-res.com/articles/esr_oa/n018p147.pdf. doi:10.3354/esr00433.
- Pentony M. 2022. Request for Competitive Interest (RFCI) and Request for Interest (RFI) for possible commercial wind energy leasing on the outer continental shelf (OCS) in the Gulf of Maine, Docket No. BOEM–2022–0041 and Docket No. BOEM–2022–0040 [official communication; letter from National Oceanic and Atmospheric Administration on 2022 Oct 3].
- Pershing AJ, Alexander MA, Brady DC, Brickman D, Curchitser EN, Diamond AW, McClenachan L, Mills KE, Nichols OC, Pendleton DE, Record NR. 2021. Climate impacts on the Gulf of Maine ecosystem: A review of observed and expected changes in 2050 from rising temperatures. *Elementa: Science of the Anthropocene*. 9(1):00076. <https://doi.org/10.1525/elementa.2020.00076>.
- Pershing AJ, Alexander MA, Hernandez CM, Kerr LA, Le Bris A, Mills KE, Nye JA, Record NR, Scannell HA, Scott JD, Sherwood GD. 2015. Slow adaptation in the face of rapid warming leads to collapse of the Gulf of Maine cod fishery. *Science* 350. 350(6262):809–812. <https://doi.org/10.1126/science.aac9819>.
- Peterson TS. 2016. Long-term bat monitoring on islands, offshore structures, and coastal sites in the Gulf of Maine, Mid-Atlantic, and Great Lakes—final report. Washington, DC: U.S. Department of Energy. 171 p.
- Pettis HM, Pace III RM, Hamilton PK. 2021. North Atlantic Right Whale Consortium 2020 Annual Report Card: Report to the North Atlantic Right Whale Consortium. 22 p. https://www.narwc.org/uploads/1/1/6/6/116623219/2020narwcreport_cardfinal.pdf.
- Pettis HM, Pace III RM, Hamilton PK. 2022. North Atlantic Right Whale Consortium 2021 Annual Report Card: Report to the North Atlantic Right Whale Consortium. 25 p. https://www.narwc.org/uploads/1/1/6/6/116623219/2021report_cardfinal.pdf.

- Pierce GJ, Santos MB, Murphy S, Learmonth JA, Zuure AF, Rogan E, Bustamante P, Caurant F, Lahaye V, Ridoux V, Zegers BN, Mets A, Addink M, Smeenk C, Jauniaux T, Law RJ, Dabin W, López A, Alonso Farré JM, González AF, Guerra A, García-Hartmann M, Reid FJ, Moffat CF, Lockyer C, Boon JP. 2008. Bioaccumulation of persistent organic pollutants in female common dolphins (*Delphinus delphis*) and harbour porpoises (*Phocoena phocoena*) from western European seas: Geographical trends, causal factors and effects on reproduction and mortality. *Environmental Pollution*. 153(2):401–415. <https://orbi.uliege.be/bitstream/2268/76635/1/Pierce2008.pdf>. doi:10.1016/j.envpol.2007.08.019.
- Pike DG, Víkingsson GA, Gunnlaugsson T, Øien N. 2009. A note on the distribution and abundance of blue whales (*Balaenoptera musculus*) in the Central and Northeast North Atlantic. NAMMCO Scientific Publications. 7:19–29. <https://doi.org/10.7557/3.2703>.
- Point 97, SeaPlan, the Surfrider Foundation. 2015. Characterization of Coastal and Marine Recreational Activity in the U.S. Northeast. http://archive.neocceanplanning.org/wp-content/uploads/2015/10/Recreation-Study_Final-Report.pdf.
- Popper A, Hawkins A. 2018. The importance of particle motion to fishes and invertebrates. *The Journal of the Acoustical Society of America*. 143:470–488. <https://doi.org/10.1121/1.5021594>.
- Popper A, Hice-Dunton L, Jenkins E, Higgs DM, Krebs J, Mooney A, Rice A, Roberts L, Thomsen F, Vigness-Raposa K, Zeddies D, Williams KA. 2022. Offshore wind energy development: Research priorities for sound and vibration effects on fishes and aquatic invertebrates. *The Journal of the Acoustical Society of America*. 151:205–215. <https://doi.org/10.1121/10.0009237>.
- Popper AN, Hawkins AD, Fay RR, Mnn DA, Bartol S, Carlson TJ, Coombs S, Ellison WT, Gentry RL, Halvorsen MB, Løkkeborg S, Rogers PH, Southall BL, Zeddies DG, Tavalga WN. 2014. Effects of Sound Exposure. Springer, Cham.: SpringerBriefs in Oceanography. https://doi.org/10.1007/978-3-319-06659-2_5.
- Quick N, Scott-Hayward L, Sadykova D, Nowacek D, Read A. 2016. Effects of a scientific echo sounder on the behavior of short-finned pilot whales (*Globicephala macrorhynchus*). *Canadian Journal of Fisheries and Aquatic Sciences*. 74(5):716–726. <https://doi.org/10.1139/cjfas-2016-0293>.
- Raposa KB, Schwartz ML. 2009. An ecological profile of the Narragansett Bay National Estuarine Research Reserve. Narragansett, RI: Rhode Island Sea Grant. 180 p.
- Read AJ, Drinker P, Northridge S. 2006. Bycatch of marine mammals in U.S. and global fisheries. *Conservation Biology*. 20(1):163–169. [accessed 2021/06/13]. <https://doi.org/10.1111/j.1523-1739.2006.00338.x>. doi:10.1111/j.1523-1739.2006.00338.x.
- Richardson WJ, Greene CR, Malme C, Thompson DH. 1995. Marine mammals and noise. San Diego, CA: Academic Press.
- Roberts JJ, Best BD, Mannocci L, Fujioka E, Halpin PN, Palka DL, Garrison LP, Mullin KD, Cole TV, Khan CB, McLellan WA, Pabst DA, Lockhart G. 2016. Habitat-based cetacean density models for the U.S. Atlantic and Gulf of Mexico. *Scientific Reports*. 6:22615. <https://www.nature.com/articles/srep22615>. doi:<https://doi.org/10.1038/srep22615>.

- Roberts JJ, Mannocci L, Halpin PN. 2017. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016–2017 (Opt. Year 1). Durham, NC: Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab. 76 p. https://seamap.env.duke.edu/seamap-models-files/Duke/Reports/AFTT_Update_2016_2017_Final_Report_v1.4_excerpt.pdf.
- Roberts JJ, Mannocci L, Schick RS, Halpin PN. 2018. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2017–2018 (Opt. Year 2). Durham, NC: Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab. 113 p. https://seamap.env.duke.edu/seamap-models-files/Duke/Reports/AFTT_Update_2017_2018_Final_Report_v1.2_excerpt.pdf.
- Roberts JJ, Schick RS, Halpin PN. 2020. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2018–2020 (Option Year 3). Document version 1.4. Durham, NC: Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab. 142 p. https://seamap.env.duke.edu/seamap-models-files/Duke/Reports/AFTT_Update_2018_2020_Final_Report_v1.4.pdf.
- Rolland RM, Parks SE, Hunt KE, Castellote M, Corkeron PJ, Nowacek DP, Wasser SK, Kraus SD. 2012. Evidence that ship noise increases stress in right whales. *Proceedings of the Royal Society B*. 279(1737):2363–2368. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3350670/pdf/rsrb20112429.pdf>. doi:10.1098/rspb.2011.2429.
- Ruppel CD, Weber TC, Staaterman E, Labak SJ, Hart PE. 2022. Categorizing active marine acoustic sources based on their potential to affect marine animals. *Journal of Marine Science and Engineering*. 10(9):1278. <https://doi.org/10.3390/jmse10091278>.
- Samuel Y. 2004. Underwater Low-frequency Noise and Anthropogenic Disturbance in a Critical Sea Turtle Habitat. Ithaca, NY: Cornell University.
- Samuel Y, Morreale SJ, Clark CW, Greene CH, Richmond ME. 2005. Underwater, low-frequency noise in a coastal sea turtle habitat. *Journal of the Acoustical Society of America*. 117(3):1465–1472. <https://pubs.aip.org/asa/jasa/article-abstract/117/3/1465/543741/Underwater-low-frequency-noise-in-a-coastal-sea?redirectedFrom=fulltext>. doi:10.1121/1.1847993.
- Schmid JR. 1998. Marine turtle populations on the west-central coast of Florida: results of tagging studies at the Cedar Keys, Florida, 1986–1995. *Fishery Bulletin*. 96:589–602. <https://spo.nmfs.noaa.gov/sites/default/files/pdf-content/fish-bull/schmid.pdf>.
- Seidov D, Mishonov A, Parsons R. 2021. Recent warming and decadal variability of Gulf of Maine and Slope Water. *Limnology and Oceanography*. 66(9):3472–3488. <https://doi.org/10.1002/lno.11892>.
- Seminoff JA, Allen CD, Balazs GH, Dutton PH, Eguchi T, Haas H, Hargrove SA, Jensen MP, Klemm DL, Lauritsen AM. 2015. Status review of the green turtle (*Chelonia mydas*) under the Endangered Species Act. La Jolla, CA: 599 p. Report No.: NOAA-TM-NMFS-SWFSC 539.

- Shaver DJ, Rubio C. 2008. Post-nesting movement of wild and head-started Kemp's ridley sea turtles *Lepidochelys kempii* in the Gulf of Mexico. *Endangered Species Research*. 4(1-2):43–55. <https://www.int-res.com/articles/esr2008/4/n004p043.pdf>. doi:10.3354/esr00061.
- Shaver DJ, Schroeder BA, Byles RA, Burchfield PM, Pena J, Márquez R, Martinez HJ. 2005. Movements and home ranges of adult male Kemp's ridley sea turtles (*Lepidochelys kempii*) in the Gulf of Mexico investigated by satellite telemetry. *Chelonian Conservation and Biology*. 4(4):817–827.
- Shelbourne M. 2023. Bath Iron Works Delivers Destroyer Carl M. Levin to Navy: USNI News (January 2023). [accessed May 17 2023]. <https://news.usni.org/2023/01/30/bath-irons-works-delivers-destroyer-carl-m-levin-to-navy>.
- Siedlecki SA, Salisbury J, Gledhill DK, Bastidas C, Meseck S, McGarry K, Hunt CW, Alexander M, Lavoie D, Wang ZA, Scott J, Brady DC, Mlsna I, Azetsu-Scott K, Liberti CM, Melrose DC, White MM, Pershing A, Vandemark D, Townsend DW, Chen C, Mook W, Morrison R. 2021. Projecting ocean acidification impacts for the Gulf of Maine to 2050: New tools and expectations. *Elementa: Science of the Anthropocene*. 9(1):00062. <https://doi.org/10.1525/elementa.2020.00062>.
- Sjollema AL, Gates JE, Hilderbrand RH, Sherwell J. 2014. Offshore Activity of Bats Along the Mid-Atlantic Coast. *Northeastern Naturalist*. 21(2):154–163. <https://doi.org/10.1656/045.021.0201>.
- Smith A, McWilliams S. 2016. Bat Activity During Autumn Relates to Atmospheric Conditions: Implications for Coastal Wind Energy Development. *Journal of Mammalogy*. 97(6):1565–1577.
- Spooner E, Karnauskas M, Harvey CJ, Kelble C, Rosellon-Druker J, Kasperski C, Lucey SM, Andrews KS, Gittings SR, Moss JH, Gove JM, Samhoury JF, Allee RJ, Bograd SJ, Monaco ME, Clay PM, Rogers LA, Marshak A, Wongbusarakum S, Broughton K, Lynch PD. 2021. Using Integrated Ecosystem Assessments to Build Resilient Ecosystems, Communities, and Economies. *Coastal Management*. 49(1):1–8. doi:10.1080/08920753.2021.1846152.
- Sprogis KR, Videsen S, Madsen PT. 2020. Vessel noise levels drive behavioural response of humpback whales with implications for whale-watching. *eLife*. 9:e56760. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7324156/pdf/elife-56760.pdf>. doi:10.7554/eLife.56760.
- Stantec. 2023. Maine Research Array Baseline Surveys Summary for EA. 6 p.
- State of Maine. 2021. Application for an Outer Continental Shelf renewable energy lease. Augusta, ME: 143 p. [accessed 2023 May 15]. <https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/Maine-Research-Leas-Application.pdf>.
- Stevenson DK, Johnson MR, Tuxbury S, Boelke C. 2014. Shallow water benthic habitats in the Gulf of Maine: A summary of habitat use by life stages of common marine and estuarine species. NOAA Fisheries Greater Atlantic Regional Fisheries Office. Greater Atlantic Region Policy Series 14-01. www.greateratlantic.fisheries.noaa.gov/policyseries/.

- Tamsett A, Heinonen BK, Auster PJ, Lindholm J. 2010. Dynamics of hard substratum communities inside and outside of a fisheries habitat closed area in Stellwagen Bank National Marine Sanctuary (Gulf of Maine, NW Atlantic). Silver Spring, MD: 53 p.
- Tetra Tech Inc. 2015. USCG final environmental impact statement for the Port Ambrose Project deepwater port application. Washington, DC: U.S. Coast Guard, Vessel and Facility Operating Standards. 549 p. Report No.: USCG-2013-0363.
- Tranum HC, Nilsson HC, Schaanning MT, Øxnevad S. 2010. Effects of sedimentation from water-based drill cuttings and natural sediment on benthic macrofaunal community structure and ecosystem processes. *Journal of Experimental Marine Biology and Ecology*. 383(2):111-121.
- TRC Environmental Corporation (TRC). 2012. Inventory and analysis of archaeological site occurrence on the Atlantic Outer Continental Shelf. New Orleans, LA: U.S. Department of the Interior, Bureau of Ocean Energy. 324 p. Report No.: OCS Study BOEM 2012-008.
- Trott TJ, Enterline C. 2019. First record of the encrusting bryozoan *Cribilina (Juxtacribilina) mutabilis* (Ito, Onishi and Dick, 2015) in the Northwest Atlantic Ocean. *BiolInvasions Records*. 8(3):598–607. <https://doi.org/10.3391/bir.2019.8.3.16>.
- Trott TJ, Lazo-Wasem EA, Enterline C. 2020. *Grandidierella japonica* Stephensen, 1938 Amphipoda: Aoridae) in the Northwest Atlantic Ocean. *Aquatic Invasions*. 15(2):282–296. <https://doi.org/10.3391/ai.2020.15.2.05>.
- Tsujii K, Akamatsu T, Okamoto R, Mori K, Mitani Y, Umeda N. 2018. Change in singing behavior of humpback whales caused by shipping noise. *PLOS ONE*. 13(10):e0204112. <https://doi.org/10.1371/journal.pone.0204112>.
- Turtle Expert Working Group (TEWG). 2009. An assessment of the loggerhead (*Caretta caretta*) turtle population in the Western North Atlantic Ocean. Turtle Expert Working Group, US Department of Commerce. NOAA Technical Memorandum NMFS-SEFSC, 575, 1–131.
- U.S. Army Corps of Engineers (USACE). 2023a. Disposal Area Monitoring System: Active Open Water Disposal Sites. [accessed May 18, 2023]. <https://www.nae.usace.army.mil/Missions/Disposal-Area-Monitoring-System-DAMOS/Disposal-Sites/>.
- U.S. Army Corps of Engineers (USACE). 2023b. WCSC Waterborne Commerce Statistics Center. [accessed May 24 2023]. <https://www.iwr.usace.army.mil/About/Technical-Centers/WCSC-Waterborne-Commerce-Statistics-Center-2/>.
- U.S. Coast Guard (USCG). 2022. ISLE CGBI pollution substances spilled cube. Office of Investigations & Casualty Analysis. [accessed June 1, 2023]. <https://www.bts.gov/content/petroleum-oil-spills-impacting-navigable-us-waters>.
- U.S. Coast Guard (USCG). 2023. Port Access Route Study: Approaches to Maine, New Hampshire, and Massachusetts. Docket No. USCG-2022-0047. <https://www.navcen.uscg.gov/port-access-route-study-reports>.

- U.S. Department of the Interior. 2022. Department of the Interior Policy on Consultation with Indian Tribes. 8 p. 512 DM 4. [accessed July 14, 2023].
https://www.doi.gov/sites/doi.gov/files/elips/documents/512-dm-4_2.pdf.
- U.S. Department of the Navy. 2013. Final Environmental Impact Statement/Overseas Environmental Impact Statement for Atlantic Fleet Training and Testing. [accessed May 17, 2023].
<https://www.nepa.navy.mil/Portals/20/Documents/aftteis2/aftt-feis-volume1.pdf>.
- U.S. Environmental Protection Agency (EPA). 2016. Generic Aircraft Type Emission Factors (tons/LTO).
https://www.epa.gov/sites/default/files/2016-04/documents/nei2014_genericef_table.pdf.
- U.S. Environmental Protection Agency (EPA). 2022a. Climate Change Indicators: Oceans. [accessed April 5 2023]. <https://www.epa.gov/climate-indicators/oceans>.
- U.S. Environmental Protection Agency (EPA). 2022b. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2020. [accessed May 24 2023].
<https://www.epa.gov/system/files/documents/2022-04/us-ghg-inventory-2022-main-text.pdf>.
- U.S. Environmental Protection Agency (EPA). 2022c. Ports Emissions Inventory Guidance: Methodologies for Estimating Port-Related and Goods Movement Mobile Source Emissions, EPA-420-B-22-011.
<https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1014J1S.pdf>.
- U.S. Environmental Protection Agency (EPA). 2023. Counties Designated “Nonattainment” for Clean Air Act’s National Ambient Air Quality Standards (NAAQS). [accessed May 24 2023].
<https://www3.epa.gov/airquality/greenbook/map/mapnpoll.pdf>.
- University of New Hampshire. 2023. Northeast Region Bathymetry Composite 16-Meter. Joint Hydrographic Center/Center for Coastal and Ocean Mapping; [accessed July 10 2023].
<https://ccom.unh.edu/project/wgom-bathbackscatter>.
- van der Hoop JM, Moore MJ, Barco SG, Cole TV, Daoust PY, Henry AG, McAlpine DF, McLellan WA, Wimmer T, Solow AR. 2013. Assessment of management to mitigate anthropogenic effects on large whales. *Conservation Biology*. 27(1):121–133.
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3562480/pdf/cobi0027-0121.pdf>.
- van der Hoop JM, Vanderlaan AS, Cole TV, Henry AG, Hall L, Mase-Guthrie B, Wimmer T, Moore MJ. 2015. Vessel strikes to large whales before and after the 2008 ship strike rule. *Conservation Letters*. 8(1):24–32.
- Vanderlaan ASM, Taggart CT. 2007. Vessel Collisions with Whales: The Probability of Lethal Injury Based on Vessel Speed. *Marine Mammal Science*. 23(1):144–156. <http://dx.doi.org/10.1111/j.1748-7692.2006.00098.x>.
- Varela MR, Patrício AR, Anderson K, Broderick AC, DeBel L, A. HL, Tilley D, Snape RT, Westoby MJ, Godley BJ. 2019. Assessing climate change associated sea-level rise impacts on sea turtle nesting beaches using drones, photogrammetry and a novel GPS system. *Global Change Biology*. 25(2):753–762. <https://doi.org/10.1111/gcb.14526>.

- Vires G. 2011. Echosounder effects on beaked whales in the Tongue of the Ocean, Bahamas [Master's project]. Duke University.
https://dukespace.lib.duke.edu/dspace/bitstream/handle/10161/3729/ViresG_MP_2011.pdf?sequence=1&isAllowed=y.
- Wale M, Simpson S, Radford A. 2013. Size-dependent physiological responses of shore crabs to single and repeated playback of ship noise. *Biology Letters*. 9(2):20121194.
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3639773/pdf/rsbl20121194.pdf>.
 doi:10.1098/rsbl.2012.1194.
- Wang SV, Wrede A, Tremblay N, Beermann J. 2022. Low-frequency noise pollution impairs burrowing activities of marine benthic invertebrates. *Environmental Pollution*. 310(119899).
- Warden ML. 2011. Modeling loggerhead sea turtle (*Caretta caretta*) interactions with US Mid-Atlantic bottom trawl gear for fish and scallops, 2005–2008. *Biological Conservation*. 144:2202–2212.
<https://doi.org/10.1016/j.biocon.2011.05.012>.
- Waring GT, Josephson E, Maze-Foley K, Rosel PE. 2012. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2011. NOAA Technical Memorandum NMFS-NE-221.
- Waring GT, Josephson E, Maze-Foley K, Rosel PE. 2015. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments – 2018. Woods Hole, MA: U.S. Department of Commerce, National Fisheries Science Center. 370 p. NOAA Technical Memorandum NMFS-NE-258.
<https://repository.library.noaa.gov/view/noaa/5043>.
- Weilgart L. 2018. The impact of ocean noise pollution on fish and invertebrates. Oceanscare and Dalhousie University.
- Whitney NM, Wanamaker AD, Ummenhofer CC, Johnson BJ, Cresswell-Clay N, Kreutz KJ. 2022. Rapid 20th century warming reverses 900-year cooling in the Gulf of Maine. *Communications Earth & Environment*. 3(179). <https://www.nature.com/articles/s43247-022-00504-8.pdf>.
 doi:10.1038/s43247-022-00504-8.
- Williams TM, Blackwell SB, Tervo O, Garde E, Sinding M-H, Richter B, Heide-Jørgensen MP. 2022. Physiological responses of narwhals to anthropogenic noise: A case study with seismic airguns and vessel traffic in the Arctic. *Functional Ecology*. 36:2251–2266.
<https://doi.org/10.1111/1365-2435.14119>.
- Wisniewska DM, Johnson M, Teilmann J, Siebert U, Galatius A, Dietz R, Madsen PT. 2018. High rates of vessel noise disrupt foraging in wild harbour porpoises (*Phocoena phocoena*). *Proceedings of The Royal Society B*. 285:20172314.
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5829196/pdf/rsob20172314.pdf>.
 doi:10.1098/rsob.2017.2314.
- Woods Hole Oceanographic Institution. 2022. Woods Hole Oceanographic Institution-led study explores effects of noise on marine life. <https://www.whoi.edu/press-room/news-release/woods-hole-oceanographic-institution-led-study-explores-effects-of-noise-on-marine-life/>.

World Resources Institute (WRI). 2017. Emission Factors from Cross Sector Tools.

https://ghgprotocol.org/sites/default/files/2023-05/Emission_Factors_from_Cross_Sector_Tools_March_2017%20%281%29.xlsx.

ZoBell VM, Frasier KE, Morten JA, Hastings SP, Peavey Reeves LE, Wiggins SM, Hildebrand JA. 2021.

Underwater noise mitigation in the Santa Barbara Channel through incentive-based vessel speed reduction. Scientific Reports. 11(1):18391. <https://www.nature.com/articles/s41598-021-96506-1.pdf>.

Appendix F: Public Comments and BOEM's Responses

F.1 Introduction

BOEM solicited comments from the public on the Wind Energy Research Lease EA during: (1) a 30-day public scoping period from May 4 to June 5, 2023, and (2) a 30-day public comment on the Draft EA from July 21 to August 21, 2023. This appendix outlines the methodology used to analyze public comments, summarizes key themes or issues conveyed in comments, and provides BOEM's responses.

F.1.1 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, which commenced the public scoping process for identifying issues and potential alternatives for consideration in the EA. The formal scoping period was from May 4 through June 5, 2023. During this timeframe, federal agencies, state and local governments, and the general public had the opportunity to help BOEM identify potential significant resources and issues, IPFs, reasonable alternatives, and potential mitigation measures to analyze in the EA, as well as to provide additional information. 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. The comments can be viewed at www.regulations.gov by searching for docket ID BOEM-2023-0031-0002.

F.1.2 Notice of Availability of a Draft EA

On July 21, 2023, BOEM released a Notice of Availability of a Draft EA for the Wind Energy Research Lease in the *Federal Register*. The Draft EA was available for public comment through August 21, 2023. During the comment period, BOEM held two virtual public meetings for the Draft EA on August 1 and August 3, 2023. During the 30-day comment period, BOEM received 16 unique comment submissions from representatives of federal and state government entities; business associations; advocacy groups; and the general public, including 4 comments made verbally during the virtual public meetings. The comments can be viewed at www.regulations.gov by searching for docket ID BOEM-2023-0042.

F.1.3 Comment Review and Response Protocol

All comment submissions were reviewed and systematically categorized in the same manner. One or more comment excerpts from each submission were categorized to a single topic and summarized for review and response.

F.2 Summary of Comments

This section provides an overview and summary of the comments received by topic and is not intended to be a reproduction of the exact wording of individual comments. The summaries illustrate the varied issues, concerns, and requested changes presented in the public comments. BOEM responses to comments refer readers to where issues are discussed in the Final EA, acknowledge revisions made in

response to comments or provide rationale for not making revisions, and provide other clarifications and information.

F.2.1 Purpose and Need

Comment Summary

Commenters noted the importance of issuing a research lease for the State of Maine’s proposed Research Array to help understand the performance and impacts of floating offshore wind turbines and other related infrastructure and activities in the Atlantic OCS and beyond. Commenters cited the need for more research on marine species, habitat, and existing ocean uses in the Gulf of Maine, and application of this information to identify ways to avoid or mitigate impacts on the environment and existing uses. A commenter also expressed interest in additional research projects if they can be made to replicate the environmental conditions that will be present in offshore wind farms, and are capable and can work concurrently with research vessels to fill additional data gaps on the effects on ocean meteorological, hydrological, and ecological dynamics.

BOEM Response to Comments

BOEM concurs that site assessment and site characterization activities associated with the State of Maine’s proposed research lease and other research activities in the Gulf of Maine will be valuable to enhancing understanding of the marine ecosystem and its responses to offshore wind development. At this time, BOEM has not received applications for additional research leases, but will review any requests received.

F.2.2 Proposed Action

Comment Summary

Commenters requested that BOEM ensure sufficient baseline data characterizing marine species distribution and abundance, marine habitat, and existing ocean uses are collected in the area to adequately inform the design and potential impacts of developing the Research Array. Commenters requested that studies and monitoring continue throughout the lifespan of the Research Array and be applied to evaluate potential future commercial offshore wind development in the Gulf of Maine. Commenters also emphasized the importance of prioritizing and designing the various research activities that would be conducted for the lease in consultation with subject matter experts and developing a plan for sharing research results.

Commenters suggested incorporation of project design criteria and best management practices into the Proposed Action to ensure that impacts on marine resources, habitats, and uses due to site assessment and site characterization activities are minimized. One commenter indicated that the proposed location of the research lease was optimal for avoidance and minimization of impacts on wildlife species, while others indicated that the Research Lease Area would present hazards for navigation and vessel traffic. Several commenters noted the importance of micrositing of buoys and other equipment to avoid impacts on live bottom features. One comment requested that BOEM share timelines for assessment and characterization activities. Another commenter requested review and confirmation that the terms “RFCI area” and “Research Lease Area” were used appropriately in the EA.

BOEM Response to Comments

The site assessment and site characterization activities described for the Proposed Action are intended to gather sufficient baseline data to inform future design, development, and permitting decisions. Prior to approval of a RAP or construction and operations plan, BOEM requires lessees to demonstrate that they have collected sufficient data and information for BOEM to conduct technical, NEPA, and other required reviews.

Under the Proposed Action, BOEM would require the lessee to avoid, minimize, or mitigate potential impacts of the Proposed Action on the environment by complying with the requirements summarized in **Chapter 5. Table 5-1** of the EA summarizes and incorporates by reference project design criteria and best management practices developed through programmatic consultation with NMFS under Section 7 of the ESA regarding data collection and site survey activities for renewable energy on the Atlantic OCS, which include provisions requiring avoidance of live bottom features and minimization of interactions with listed species. **Table 2-1** of the EA describes the site assessment and site characterization activities evaluated as part of the Proposed Action and the approximate time periods during which these activities would be conducted. The precise timing and location of the various activities would be further refined after issuance of the lease and in some cases iteratively over the duration of the assessment period. BOEM will continue to update interested parties after the conclusion of the NEPA process through Task Force meetings, the BOEM Gulf of Maine website, press releases, and other public engagement activities as necessary.

BOEM reviewed and applied corrections as necessary to appropriately distinguish between “RFCI area” and “Research Lease Area” in the EA.

F.2.3 Alternatives

Comment Summary

One commenter suggested that any decision that identifies an alternative location for issuance of the research lease that departs from the State of Maine’s requested lease area should be easily understood, transparent, and fully supported by the best available science, best practices, and law. The commenter recommended that BOEM consider data quality and availability, locations of hard-bottom habitat and potential coral in areas with slopes greater than 10 percent, minimization of conflicts with the fishing industry, potential loss or displacement of fishing activities, and engagement with tribes and indigenous communities to identify resources of interest when identifying alternatives.

There was a request for collaboration and coordination with the Maine Department of Marine Resources to utilize the data and information gathered during its outreach efforts in the development of alternative leasing areas within the RFCI. The commenter suggested that feedback collected by the Maine Department of Marine Resources could be valuable for the formulation of alternatives.

BOEM Response to Comments

As described in the EA, under the Proposed Action, BOEM would issue a research lease within portions of an approximately 68,320-acre (276-km²) area (referred to in this EA as the Research Lease Area) that would support a project not to exceed 10,000 acres and would site the lease in a location that minimizes impacts on conflicting uses. The Proposed Action encompasses the possibility that the research lease could be issued at various locations within the broader Research Lease Area and analyzes potential

impacts throughout the Research Lease Area; therefore, specific research lease locations within the broader Research Lease Area were not analyzed as independent alternatives. Certain site characterization surveys would also be conducted 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. Through preparation of the EA and associated consultations, BOEM reached a determination that SOC and mitigation summarized in **Chapter 5** of the EA would be sufficient to avoid, minimize, or mitigate potential impacts of the Proposed Action without the need to develop separate alternatives.

Existing data from the Maine Department of Marine Resources and other sources were considered in the State of Maine's identification of the requested lease area. The Maine Department of Marine Resources has participated in the planning for and would conduct certain survey activities under the Proposed Action to gather additional data to inform potential future development of the Research Array. BOEM has initiated outreach with the Maine Department of Marine Resources, Maine Coastal Program as part of the Coastal Zone Management Act consistency determination. BOEM will continue to work with the Maine Department of Marine Resources and other local governments throughout the development of the EA.

F.2.4 NEPA / Public Involvement Process

Comment Summary

Commenters encouraged BOEM to continue to inform and engage the public throughout the NEPA process and fulfill consultation requirements with NMFS, NOAA, and USFWS. One commenter noted the need to complete federal consistency reviews of the Proposed Action with enforceable state coastal programs under the authority of the Coastal Zone Management Act. Commenters encouraged BOEM to ensure data collected during site assessment and characterization efforts are standardized and made publicly available. One commenter expressed concern that they had not yet received responses to substantive comments provided earlier in the leasing process, including comments made in response to BOEM's RFCI, RFI, and Call for Information, and the administrative Draft EA, and that these comments be considered in the Final EA.

Commenters stressed the importance of engaging interested parties to ensure all voices are being heard, and specifically encouraged BOEM to engage tribes and fishermen. One commenter indicated that areas considered for future offshore wind development include areas where Maine's indigenous tribes have unceded fishing rights. Some commenters remarked that BOEM has initiated too many public comment periods for the public to provide meaningful input and that BOEM does not consider similar public comments received on individual projects collectively. Other commenters requested that BOEM prepare an environmental impact statement rather than an EA in order to meet NEPA requirements for analysis of cumulative effects and provide more robust public engagement opportunities. Some commenters encouraged BOEM to pursue a programmatic environmental impact statement with tiered analyses for individual projects in order to fully assess and coordinate mitigation for future actions.

One commenter requested clarification on the State of Maine's role in the NEPA process.

BOEM Response to Comments

BOEM is committed to robust engagement and outreach throughout the permitting process and appreciates feedback and suggestions for improvement. BOEM considered all comments received during the public scoping and public review periods for this EA. As discussed in **Section 1.3** of the EA, comments received in response to the August 19, 2022, RFCI for the research lease were also used to inform the EA. Comments made in response to RFIs and Calls for Information for commercial leasing were not specifically considered for this EA. Throughout the NEPA process, BOEM has engaged in focused discussions with cooperating agencies to resolve specific comments and concerns. BOEM also hosted two virtual public meetings during the review period for this EA. In service of meeting federal and state renewable energy goals and responding to expressions of interest in leasing and proposals from lessees, BOEM is currently reviewing a large number of offshore wind actions. In general, BOEM must independently fulfill regulatory requirements of each action, including requisite public notices and comment periods. The agency is implementing various strategies intended to make engagement easier and more efficient for the public, such as hosting virtual public meetings and providing virtual meeting materials.

Chapter 6 of the EA describes various consultations or reviews conducted in association with the NEPA process, including requirements under the ESA, Magnuson-Stevens Fishery Conservation and Management Act, Coastal Zone Management Act, and National Historic Preservation Act. BOEM is required to consult with federally recognized tribes if a BOEM action would have tribal implications, defined as any departmental regulation, rulemaking, policy, guidance, legislative proposal, grant funding formula changes, or operational activity that may have a substantial direct effect on a tribe. In recognition of this relationship, BOEM has invited tribes to participate as consulting parties under Section 106 of the National Historic Preservation Act, participate in Task Force meetings, and meet directly with BOEM.

BOEM has determined that an EA is the appropriate level of NEPA review for this research lease because EAs are prepared for actions that are not likely to have significant effects on the human environment (40 CFR 1501.5(a)), as supported by the analysis in this EA. If BOEM receives a RAP for development of the Research Array, BOEM would conduct a subsequent NEPA analysis evaluating potential future construction and operation of floating offshore wind turbines, installation of inter-array and export cables, and associated wind energy-related research facilities. BOEM would determine the appropriate level of NEPA analysis as well as consider the values of programmatic and project-specific approaches after receiving the RAP. Any subsequent NEPA process would provide additional opportunities for public involvement, pursuant to NEPA requirements.

The State of Maine is an applicant for the research lease and would conduct or direct various surveys described under the Proposed Action. Additionally, the Maine Department of Marine Resources has a role in evaluating the consistency of the Proposed Action with enforceable policies of the State's coastal program under the authority of the Coastal Zone Management Act.

F.2.5 Planned Activities Scenario / Cumulative Impacts

Comment Summary

Commenters expressed concern that BOEM's approach to evaluating cumulative effects from offshore wind-related activities has been inadequate. Commenters believe further research is needed to

meaningfully assess the cumulative impacts from offshore wind in the Gulf of Maine and along the Atlantic OCS. Specific concerns about the Proposed Action raised by commenters include potential alteration of benthic habitat, loss of habitat and mortality of marine mammals and fish, changes in marine species behavior, increased pressure and conflicts from recreational users, displacement of fishing activities, and increased navigational risk for marine shipping vessels. A commenter also requested that BOEM cite additional research and further describe the cumulative effects of rising ocean temperatures in the Gulf of Maine.

A commenter noted that the planned activities scenario should include any other offshore wind lease development as planned because these leases will likely have site assessment activities that could affect resources in the same location or timeframe as the Proposed Action. Another commenter requested that the cumulative effects analysis account for construction, operation, and decommissioning activities and not decouple them from site assessment and characterization activities. Additional comments focus on the need to include consideration of increases in traffic to ports and the consolidation of fairways based on possible future leases.

BOEM Response to Comments

The cumulative impact analysis included in the EA considers the incremental effects of ongoing and planned activities in combination with the impacts of the Proposed Action. As described in **Chapter 4** of the EA, 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. Cumulative impacts are evaluated for each resource (e.g., benthic habitat, marine mammals, recreation and tourism) and summarized in **Table 4-1** of the EA. At this time, no other offshore wind actions within the Gulf of Maine meet BOEM's criteria for consideration as reasonably foreseeable actions and, therefore, none are included in the ongoing and planned activities scenario provided in **Appendix C**. However, provided there would be temporal overlap between the activities, subsequent NEPA documents would consider cumulative impacts of ongoing site assessment and site characterizations activities for the research lease in combination with commercial leasing activities for any commercial leases that have been issued at that time.

F.2.6 Analysis Scope, Methods, and Assumptions

Comment Summary

Commenters characterized the Gulf of Maine as data poor and identified the research lease as an opportunity to close critical data gaps including benthic habitat characterization, comprehensive seafloor mapping, ichthyoplankton sampling, and ecological baseline monitoring studies. Where data are unavailable, commenters advised BOEM to acknowledge the uncertainties and existing gaps in the data. In the pursuit of using the best available information and addressing concerns of interested parties, commenters encouraged BOEM to use indigenous knowledge to inform impact assessments.

Several commenters indicated that the EA did not provide sufficient analysis and rationale to support the impact level conclusions and determinations made therein. One commenter noted that the definitions of impact determinations were vague, and several factors were not consistently applied in the analysis.

A few commenters requested that the affected environment section be expanded and cite additional sources to more fully describe the condition of existing resources so as to benchmark impacts for comparison to future conditions.

BOEM Response to Comments

Table 2-1 of the EA describes the site assessment and site characterization activities included in the Proposed Action. Benthic, geotechnical, seafloor habitat characterization, plankton and larval lobster, and marine mammal and wildlife surveys are all planned to be conducted as part of the Proposed Action.

In pursuit of information about interests and concerns of tribes and indigenous knowledge, BOEM has invited tribes to participate as consulting parties under Section 106 of the National Historic Preservation Act, participate in Task Force meetings, and meet directly with BOEM.

Definitions of impact determinations used in this EA are consistent with impact determinations used in other BOEM leasing EAs and sufficient to inform BOEM's decision. After additional review, BOEM considers the impact analysis and impact determinations appropriate based on the nature and scale of activities proposed relative to the ongoing activities in the GAA.

As described in responses to comments on specific resource topics, the description of the affected environment was revised in select areas after consideration of comments requesting additional citations, clarifications, or other revisions. Overall, BOEM considers the level of detail presented in the affected environment sufficient for public disclosure and to inform BOEM's decision of whether to issue the research lease.

F.2.7 Mitigation and Monitoring

Comment Summary

Commenters emphasized the need for comprehensive baseline analysis and monitoring to fully evaluate the effects of future offshore wind energy projects on wildlife species and their habitats. Commenters recommended specific methodologies to conduct monitoring of marine resources, such as impact detection devices to study bird and bat interactions with turbines, monitoring anchor and mooring cables for debris and animal entanglement, and monitoring the impacts of floating offshore wind technology on hydrodynamic effects.

Commenters requested BOEM ensure the use of robust monitoring and minimization of impacts on marine resources, habitats, and uses, particularly impacts on large whale species and fish habitat. Several commenters requested that BOEM require various mitigation measures and restrictions including requirement of clearance zone and exclusion zone distances; prevention and recovery of lost gear; mandatory reporting and shutdown of activities if a large whale species is detected; mandatory vessel speed restrictions; underwater noise reduction; PSOs, time-of-year restrictions and compensatory mitigation; and transmission cable route surveys that avoid impacts on navigation. Some commenters asked that BOEM work with the prospective lessee to develop alternative survey plans for fisheries resources and explore alternative non-lethal or minimally lethal sampling approaches alongside more traditional survey methods. Commenters also emphasized the need for early, effective, and timely coordination in the consultation process with tribes and other agencies for collaborative development of

mitigation and monitoring requirements. One commenter asked that BOEM apply the mitigation and monitoring efforts discussed in the EA as conditions of lease issuance.

In addition to applying mitigation to reduce impacts from site assessment and characterization activities, commenters suggested that the research lease also be used as an opportunity to test and develop mitigation and monitoring technologies and protocols for future offshore wind development.

Commenters also suggested changes to the EA, including updates to SOCs and mitigation in **Appendix D** and removal of mitigation as part of the impact determination definitions.

BOEM Response to Comments

The various surveys and monitoring activities that would be conducted under the Proposed Action are intended to gather comprehensive baseline data about marine wildlife and their habitat within the research lease and potential future grants and easements. These activities include benthic surveys, seafloor habitat characterization sampling and surveys, physical oceanographic monitoring, digital aerial surveys to map seasonal occurrence and activity of marine species including large fish, active acoustic surveys and environmental DNA sampling of marine fish and invertebrates, passive acoustic monitoring of large pelagic and benthic fish, bottom-trawl surveys for marine fish and invertebrates, plankton and larval lobster surveys, and lobster trap surveys. **Table 2-1** of the EA describes the site assessment and site characterization activities evaluated as part of the Proposed Action.

Table 5-1 of the EA summarizes and incorporates by reference the SOCs and mitigation measures that would apply to site assessment and site characterization activities conducted as a result of the Proposed Action. These include project design criteria and best management practices developed through programmatic consultation with NMFS under Section 7 of the ESA with provisions for avoiding or minimizing risk of collisions and entanglements with marine species, PSO and reporting requirements, and time-of-year restrictions for conducting benthic surveys in Atlantic or shortnose sturgeon spawning habitat. All SOCs and mitigation measures would be applied as lease stipulations. Although certain SOCs and mitigation measures require real-time monitoring, such as the presence of PSOs on vessels conducting visual wildlife surveys, BOEM has not identified a need to require additional monitoring of potential effects from the site assessment and characterization activities due to the negligible to minor level of impacts anticipated. However, additional mitigation and monitoring would be required 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 BOEM would evaluate in a subsequent environmental analysis after receiving the RAP.

The impact conclusions presented in **Section 3.3** of the EA indicate whether the determinations were made with or without consideration of application of mitigation measures.

F.2.8 Air Quality and Greenhouse Gas Emissions

Comment Summary

A commenter expressed concern that the potential risks to the ocean through the development of offshore wind infrastructure would not be offset by the realized beneficial impacts related to climate change. Specifically, the comment discusses the net increase of atmospheric carbon dioxide as a result of the project.

BOEM Response to Comments

The evaluation of impacts from the construction, installation, and operation of a full-scale wind energy facility are outside of the scope of analysis for the Proposed Action and are therefore not addressed in the EA. However, the EA does evaluate the contribution of emissions from vessels and aircraft for site assessment activities as part of the Proposed Action in Section 3.3.1, *Air Quality and Greenhouse Gas Emissions*. Estimated annual emissions, potential criteria pollutant emissions, and GHG emissions for Years 1–7 are summarized in **Appendix B** of the EA.

F.2.9 Water Quality

Comment Summary

A commenter requested that the project’s water quality be further described, including any available information on ambient conditions such as total suspended solids, water currents, temperature, or salinity. The commenter also requested the EA note that water quality can vary widely in the Gulf of Maine, particularly due to the influence of the Labrador Current and the Gulf Stream.

BOEM Response to Comments

Section 3.2.3 of the EA describes and discusses classifications of the Gulf of Maine water quality. As described, the Maine Department of Environmental Protection, Marine Environmental Monitoring Program classifies the majority of marine and coastal waters as SB, with water intermittently classified as SA. The Maine Department of Environmental Protection also assesses the condition of waterbodies in Maine and assigns each to one of five categories based on the most recent available water quality data. The conclusions drawn in the EA were made with the understanding of different sources that may affect water quality in the Gulf of Maine. As discussed in **Section 3.3.2.2**, impacts on coastal and marine water quality would be negligible even without mitigation, as any changes to water quality would be small in magnitude, highly localized, and transient.

F.2.10 Benthic Resources

Comment Summary

Commenters requested that comprehensive baseline monitoring studies of benthic habitats be conducted, and studies conducted should ensure that critical data gaps are filled. Comments encouraged the consideration of potential coral areas and hard bottom within the Research Lease Area. Comments also requested that BOEM consider areas greater than 10-percent slope as potential hard bottom and areas with greater than 30-percent slope as very likely hard bottom. BOEM was asked to not assume areas containing poor data quality are suitable for development. Detailed analysis and consideration of impacts on benthic resources were requested. One commenter indicated that, in general, the sections regarding benthic resources do not establish a baseline condition of potentially affected benthic resources. In addition, the commenter noted inconsistencies in the level of detail used to describe impacts from benthic surveys across different resource sections, such as quantification of the potential disturbance of seafloor sediment. The same commenter requested incorporation of additional information, including key benthic species, habitat types, estuaries of national significance, eelgrass, basins and underwater mountain ranges, deep sea coral and sponges, and climate change.

BOEM Response to Comments

Benthic surveys and seafloor habitat characterization sampling and surveys are included as part of the Proposed Action, which, if selected, would help fill data gaps for the Gulf of Maine. The benthic surveys conducted as part of site assessment and site characterization activities would help inform the placement of potential future offshore wind infrastructure, as well as enable detailed analysis of potential impacts of offshore wind development activities.

In keeping with the directive of the NEPA implementation regulations at 40 CFR 1502.2(c), this EA is not intended to provide an encyclopedic description of benthic species and habitats throughout the Gulf of Maine, but rather focuses on those specific areas and resources most likely to be affected by site assessment and characterization activities and describes the affected environment with a level of detail commensurate with the anticipated level and type of impacts.

F.2.11 Finfish, Invertebrates, and Essential Fish Habitat

Comment Summary

Commenters requested that BOEM ensure that fish, fisheries, and habitat data within and around the Research Lease Area be documented, along with the quality of the available data for these resources. Specifically, commenters noted that the analysis should consider overlapping HAPCs and HMAs. Commenters emphasized the need for comprehensive baseline data for determining the impacts on finfish, invertebrates, and associated habitat. These impacts should include those associated with wind energy development as well as pre-construction monitoring. Commenters emphasized the need for data collection and research regarding the acoustic impacts of offshore wind and seismic surveys on invertebrate species. Commenters discussed the potential displacement of fish species and the impact of offshore wind development on various life stages and processes of fish.

One commenter provided comments on the EFH Assessment prepared for the research lease, requesting mapping of habitat within the project area in accordance with the Recommendations for Mapping Fish Habitat document (dated March 2021) and sharing of habitat mapping data in a usable, geographic information system format for ease of review.

Commenters requested that BOEM confirm that the EA cites the most recent data for the diversity of invertebrate species in the Gulf of Maine. In addition, commenters noted that several HMAs were not listed. Lastly, several commenters noted that site characterizations regarding finfish, invertebrates, and EFH should not rely on previous lease issuance EAs or the Atlantic G&G Final Programmatic EIS.

Finally, BOEM was asked to consult with NMFS throughout this process to ensure the impacts on EFH are fully analyzed. Commenters also requested that all site assessment and characterization activities avoid all HAPCs.

BOEM Response to Comments

Multiple surveys aimed at creating a comprehensive baseline of finfish and habitat around the Research Lease Area are included as part of the Proposed Action, including benthic surveys, seafloor habitat characterization sampling and surveys, digital aerial surveys to map seasonal occurrence and activity of marine species including large fish, active acoustic surveys and environmental DNA sampling of marine fish and invertebrates, passive acoustic monitoring of large pelagic and benthic fish, bottom-trawl

surveys for marine fish and invertebrates, plankton and larval lobster surveys, and lobster trap surveys. Detailed descriptions of these surveys can be found in **Table 2-1** of the EA. Additionally, **Section 3.2.5** of the EA includes descriptions of existing baseline conditions of finfish, invertebrates, and EFH. The EA also includes a discussion of the potential impacts of these surveys, including acoustic impacts from surveys and potential displacement of species, on finfish, invertebrates, and EFH in **Section 3.3.4**. The evaluation of impacts from the construction, installation, and operation of a full-scale wind energy facility on finfish, invertebrates, and EFH is outside of the scope of analysis for the Proposed Action and is therefore not addressed in the EA.

As described in the Proposed Action, detailed benthic habitat mapping would be conducted within the research lease and other areas potentially affected by potential future development of the Research Array. These mapping products will be available for the purposes of subsequent NEPA analysis and EFH assessment.

Various revisions were made to the finfish, invertebrates, and EFH section in the Final EA based on comments received, including listing of additional highly migratory species, further description of the Jeffrey's Ledge/Stellwagen Bank HAPC, and clarification and revisions to **Figure 3-2** depicting HAPCs. BOEM reviewed and confirmed the affected environment presents the best available data or updated the discussion accordingly. Incorporation by reference of previous lease issuance EAs and the Atlantic G&G Final Programmatic EIS has been maintained because the types of surveys and equipment proposed to be utilized are for site characterization activities and are the same or very similar equipment; however, the impact analysis and determinations in this EA were made with specific consideration for conditions in the Gulf of Maine.

F.2.12 Marine Mammals

Comment Summary

Commenters raised concerns regarding the potential impacts of offshore wind development on NARW and other marine mammals. Increased vessel traffic and infrastructure associated with offshore wind development could pose additional risk to NARW. Impacts on NARW would not only affect the species but would also provide repercussions for the commercial fishing industry, which is being asked to reduce impacts on NARW. The impacts from offshore wind development could affect the NARW population through increased traffic and vessel strikes, entanglement, and increased noise and use of sonar in the area. Additionally, commenters requested that BOEM assess the loss of NARW communication and listening range in order to describe real impacts on quality-of-life metrics.

One commenter expressed concerns that the Marine Mammal Densities derived from the Duke University habitat-based density model are not entirely accurate given that the model is currently being updated. The commenter noted that BOEM should not use it as the sole information source when measuring occurrence, density, and impact.

In an effort to mitigate the risks to NARW, commenters requested monitoring and data collection to establish baseline information. Studies and research should focus on impacts of noise-generating offshore wind activities, including site assessment, as well as the upwelling and waters utilized by NARW. Commenters noted that areas influenced by strong upwelling are often where whales feed. Commenters noted that the Research Lease Area is between the historically important whale areas of

Platts Bank, Three Dory Ridge, and Jeffrey's Bank and only 10 miles from Cashes Ledge, and warned that lower observations to date may be inaccurate.

In addition to gathering information, best management practices are recommended including the following:

- Establish an exclusion zone of 500–1,000 meters around noise-producing vessels (greater than 180 dB re 1 μ Pa (SPL) at 1 meter, frequencies 7–35 kHz). Monitor the zone for NARW before and during geophysical survey activities, halting or delaying the activity if a whale is detected.
- Implement comprehensive exclusion zone monitoring using NOAA-approved PSOs and passive acoustic monitoring near the zone. Each PSO should cover 180 degrees during daylight, with additional measures like night-vision and thermal imaging at night.
- Begin geophysical survey equipment deployment during daylight hours and good visibility conditions to ensure whales are clear of the exclusion zone. If halted due to whale presence, wait for daylight to recommence.
- Enforce a speed limit of 10 knots or less for all project vessels to mitigate the risk of vessel strikes on NARW.

A commenter recommended the use of a lighthouse south of Mount Desert Island for marine mammal observations, as it already hosts the oldest island-based marine mammal research station in the world.

BOEM Response to Comments

Section 3.3.5 of the EA evaluates the potential impacts of the Proposed Action on marine mammals, including NARW. Factors that could contribute to potential impacts 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. Overall, impacts from site characterization and site assessment activities on marine mammals are expected to be minor because potential impacts on individuals from the scale and nature of the activities proposed, while detectable and measurable, would not threaten viability of any marine mammal species.

Section 3.2.6 of the Final EA, which describes the affected environment for marine mammals, was revised to incorporate data from the 2023 NARW calving season and provide additional context about the species' population status.

Table 5-1 of the EA summarizes and incorporates by reference the SOC's and mitigation measures that would apply to site assessment and site characterization activities conducted as a result of the Proposed Action. These include project design criteria and best management practices developed through programmatic consultation with NMFS under Section 7 of the ESA regarding data collection and site survey activities for renewable energy on the Atlantic OCS. Specific examples relevant to the comments are the establishment of clearance and shutdown zones, shut-downs, PSO monitoring, and other best management practices to avoid and reduce exposure of ESA-listed species to underwater survey noise, avoid injury of ESA-listed species, and minimize the likelihood of adverse effects associated with potential disturbance to discountable levels. Other requirements include establishing minimum separation distances between vessels and marine protected species; establishing operational protocols for vessels when animals are sighted; establishing sightings awareness for NARWs; and requiring vessel

speed limits in seasonal management areas and slow zones/dynamic management areas to avoid injury to or death of NARWs. All SOC and mitigation measures would be applied as lease stipulations.

F.2.13 Sea Turtles

Comment Summary

A commenter requested monitoring of sea turtle sensory ecology to reduce potential impacts. Additionally, a commenter recommended a 10-knot vessel speed for all vessels to reduce the risk of collisions and catastrophic damage to sea turtles.

BOEM Response to Comments

Several survey activities to develop a baseline of sea turtle activity within the Research Lease Area are included as part of the Proposed Action including digital aerial surveys and visual marine mammal and wildlife surveys. Descriptions of these surveys can be found in **Table 2-1** of the EA. Additionally, **Section 3.2.7** of the EA includes descriptions of existing baseline conditions for sea turtles.

Table 5-1 of the EA summarizes and incorporates by reference the SOC and mitigation measures that would apply to site assessment and site characterization activities conducted as a result of the Proposed Action. These best management practices include a 10-knot speed restriction for all vessels while operating in any seasonal management area or dynamic management area. All SOC and mitigation measures would be applied as lease stipulations.

F.2.15 Navigation and Vessel Traffic

Comment Summary

USCG and other members of the maritime community have indicated that the proposed research lease location would negatively affect navigation, vessel traffic, and traditional uses of the marine transportation system because the Research Lease Area is in line with commercial shipping traffic patterns entering and exiting the Eastern Approach TSS and overlaps with the new fairway proposed in the USCG 2023 Final Port Access Route Study on the Approaches to Maine, New Hampshire, and Massachusetts. Commenters voiced concerns that condensing vessel traffic into smaller operating areas would increase the risk of allision, which would be amplified further in inclement weather and during times of reduced vessel maneuverability. A commenter also noted that while existing data indicate low traffic density in the Research Lease Area, the analysis must account for future increases in vessel traffic. Commenters recommended a 2-nm buffer zone from the parallel outer or seaward boundary of a traffic lane and a minimum of a 5-nm buffer from the entry/exit termination of the TSS. A commenter requested that no temporary or permanent structures be located within the buffer zones. Commenters noted that even with these buffers, larger ships may be unable to avoid allisions or collisions. Commenters requested that BOEM consider the impacts on navigation and vessel traffic to be moderate and not minor or negligible. Commenters note that additional research and information are needed for the current conclusion of negligible to minor impacts on navigation and vessel traffic.

BOEM Response to Comments

As described in **Section 3.3.8** of the EA, the primary impact on navigation and vessel traffic would be the increase in vessel traffic for site characterization surveys and the installation, maintenance, and

decommissioning of a FLiDAR buoy. Based on AIS vessel transit count data from 2019 through 2022, high densities of vessel traffic do not pass through the Research Lease Area and, therefore, unavoidable space-use conflicts are not anticipated. The impacts on navigation for the Proposed Action will be re-evaluated when USCG finalizes its rulemakings to confirm that potential impacts on navigation would remain negligible. Additionally, BOEM has committed to siting the research lease, if issued, in a location within the Research Lease Area that minimizes impacts on navigation. Even if shipping vessel traffic were to increase in the future, siting the research lease outside of the proposed fairway and TSS buffer zone is anticipated to avoid the potential for space-use conflicts and allisions or collisions. Additionally, in its comment letter on the Draft EA dated August 21, 2023, USCG stated that it has “no objection to BOEM’s alternative of issuing a lease in a different portion of the lease area, which does not intersect with the proposed fairway.”

F.2.16 Commercial and Recreational Fishing

Comment Summary

Commenters expressed concerns about the restricted availability of waters for lobster fishing outside of the Massachusetts Restricted Area. They also discussed the financial impact of displacing lobstermen and fishermen from the proposed Research Lease Area. Specific requests were made to exclude certain areas, such as Lobster Management Area 1, Platts Bank, portions of Georges Bank, and other designated areas shown on attached maps, due to their importance to commercial fisheries.

In addition to fishing ground impacts and access, commenters emphasized the importance of utilizing the best available science and data. They requested the incorporation of VMS and Vessel Trip Report data when characterizing commercial fishing activities within the Research Lease Area. Combining vessel information with critical data like catch and revenue would provide a more comprehensive analysis of the impacts on commercial fishing. There were also calls for BOEM to ensure the collection of comprehensive baseline data to enhance impact analysis. Furthermore, members of the commercial fishing community stressed the significance of understanding the effects of renewable energy projects on fish stocks, habitat, and ecosystem function.

Commenters noted that activities authorized during site assessment and characterization also have significant impacts on fishing communities as shown in other offshore wind projects. These impacts can include injury or mortality of marine mammals, which may result in additional regulations imposed on commercial fishing. A commenter requested that BOEM analyze the impacts resulting from site assessment and characterization on commercial fishing. Additionally, the commenter asked BOEM to continue coordinating with local fishing communities to better understand where and when fishing occurs to reduce negative effects such as impacts on navigation to fishing grounds, acoustic impacts on commercial stocks, and timing of surveys on harvesting of commercial fisheries.

A specific comment focused on impacts on the harpoon fishery and emphasized that the Research Lease Area currently encompassed essential habitats for bluefin tuna and other fisheries. The comment underscored the unknown consequences of offshore wind development on these species, their habitat, and ocean currents.

Commenters urged BOEM to assess the cumulative impacts of research and renewable energy development on the commercial fishing industry, including revenue and catch losses, as well as the devaluation of permits and vessels. Compensation for residual damage to regional seafood production

was requested as a condition for the research lease. Several comments advocated for the development of an impact fees framework. The importance of evaluating the lost value associated with non-import U.S.-based fisheries was also discussed. Furthermore, commenters highlighted the cumulative impacts on fisheries resulting from development along the Atlantic coastline.

BOEM Response to Comments

Impacts of the Proposed Action on commercial and recreational fishing are described in **Section 3.3.9** of the EA. The site assessment and site characterization activities of the Proposed Action are expected to result in increased vessel traffic in the area and the temporary exclusion or displacement of vessels to prevent conflicts and collisions with survey vessels and gear. However, the exclusion and displacement as a result of survey activities are expected to be on the scale of hours and confined to the immediate area around survey ships. BOEM utilized VMS and Vessel Trip Report data to characterize commercial fishing activity around the Research Lease Area to inform the EA analysis.

The cumulative impact analysis included in the EA considers the incremental effects of ongoing and planned activities in combination with the impacts of the Proposed Action. As described in **Table 4-1** of the EA, the incremental contribution of the Proposed Action in combination with ongoing and reasonably foreseeable planned activities is expected to result in minor impacts on commercial and recreational fishing.

BOEM will continue outreach to fishery organizations and communities that rely on the Gulf of Maine. For example, BOEM hosted in-person meetings in Massachusetts, New Hampshire, and Maine in July 2023 to seek feedback and on-the-water knowledge from the Gulf of Maine fishing community to improve the spatial models used to inform draft Wind Energy Areas for potential future commercial leasing, which is being evaluated separately from the research leasing process. BOEM welcomes interested party input from the commercial and recreational fishing communities to better understand potential impacts of the research lease.

Additionally, BOEM's SAP guidance under 30 CFR 585.611(b)(8), Coastal and Marine Uses, requires a description of how site assessment activities would co-exist with other authorized use of the OCS and onshore infrastructure. Additionally, this should include a description of environmental protection measures proposed to minimize adverse effects on other coastal and marine uses. This includes plans to issue local notices to mariners of OCS activities. Surveys that are proposed in the SAP would be accompanied by development and implementation of a fisheries communication plan and inclusive of fisheries liaison officers for the project duration. The fisheries communication plan will establish principles to guide outreach and engagement with the regional fisheries community. The intent is to establish a process to gather fisheries information, establish relationships with the fisheries community, and to communicate and coordinate project-related activities for ocean co-use.

F.2.18 Cultural, Historical, and Archaeological Resources

Comment Summary

BOEM was requested to consult with federally recognized tribes in Maine, New Hampshire, and Massachusetts to obtain information on potential submerged burial sites and cultural artifacts that might be affected by the leasing activities. Commenters appreciated BOEM's noted consultation with federally recognized tribes and highlighted the importance of avoidance strategies to ensure impacts on

cultural, historical, and archaeological resources remained negligible. Commenters also asked that BOEM use Indigenous and other place-based cultural knowledge types to inform alternative lease sites within the EA.

BOEM Response to Comments

BOEM is required to consult with federally recognized tribes if a BOEM action would have tribal implications, defined as any departmental regulation, rulemaking, policy, guidance, legislative proposal, grant funding formula change, or operational activity that may have a substantial direct effect on a tribe. In recognition of this relationship, BOEM has invited tribes to participate as consulting parties under Section 106 of the National Historic Preservation Act.

BOEM initiated consultations with 11 federally recognized Native American tribes with historical and cultural ties to the region under consideration in the EA. As mentioned in **Section 6.1.1** of the EA, BOEM initiated a series of three Task Force meetings aimed at establishing a robust framework for coordination and consultation among federal, state, local, and tribal governments. These meetings were in addition to three in-person meetings targeted toward specific interested party groups to solicit feedback and six virtual meetings designed for specific interested party groups, including Tribal Nations, where BOEM was able to identify themes and key topics from each of the interested party groups to inform the planning process.

As described in **Section 3.3.11** of the EA, 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. Consequently, submerged cultural resources would be avoided during site assessment and site characterization activities.

F.2.19 General Support or Opposition

Comment Summary

BOEM received comments both in support of and opposition to the development of offshore wind. Commenters who were in support of offshore wind activities primarily highlighted their belief that offshore wind is essential to addressing the climate crisis and transitioning to a renewable energy future. Many of the supportive commenters also stated that offshore wind activities will help the nation meet its GHG emission reduction goals. Some commenters asked that BOEM ensure the Proposed Action is carried out in a way that ensures navigation safety for vessels and utilizes appropriate avoidance, minimization, and mitigation measures to keep project impacts negligible to minor. Commenters also expressed support for the research lease, stating that it would help inform the sustainable development of floating offshore wind, support innovation, standardize best practices, and help modernize surveying and monitoring techniques.

Commenters who were opposed to offshore wind were primarily concerned with socioeconomic and environmental issues and felt that operations needed to be delayed or even stopped. Other commenters cited concerns with negative impacts on coastal communities, national security, and food security when expressing their opposition. Some commenters felt that comments and concerns were ignored and BOEM had not been working under a transparent and inclusive planning process. Comments raised concerns that offshore wind energy will damage fisheries, migratory birds, marine life,

and ocean biodiversity, and that inadequate research has been completed to adequately assess these potential impacts. Commenters who expressed opposition also felt offshore wind would be a bad return on investment.

BOEM Response to Comments

BOEM acknowledges both the public's support and opposition for the Proposed Action and offshore wind development generally.

F.2.20 Research Lease Development, Commercial Leasing, or Other Out-of-Scope Topics

Comment Summary

A large number of comments addressed topics beyond the scope of this EA, including potential future offshore wind development in the Gulf of Maine for research and commercial purposes.

Commenters were primarily concerned with the potential impact of offshore wind structures including impacts on fisheries and commercial and recreational fishing, impacts of potential thermal zones from arrays on lobster fisheries, impacts on benthic habitat as a result of cable emplacement and anchoring of wind turbine generators, hydrodynamic effects of structures resulting in impacts on the local ocean temperature and chemical and biological stratification, impacts of electromagnetic fields from cables on marine species, impacts on wildlife and benthic habitat as a result of cable emplacement and wind turbine generator structures, vessel collision with marine mammals, potential impacts of mooring lines and dynamic array cables on wildlife entanglement and habitat, and impacts on birds and bats as a result of collision with structures or displacement. Some commenters asked that BOEM stop all work on any currently operational offshore wind programs, with the exception of those solely designed for research purposes, until more is known about the effects of offshore wind and until BOEM provides written replies to those who have expressed concerns.

To mitigate or potentially eliminate these potential impacts, commenters voiced support for future mitigation for commercial offshore wind development in the region including marine mammal and wildlife entanglement detection; noise reduction during construction and operation; aircraft detection lighting on wind turbine generators; collision detection and mitigation for birds and bats; time-of-year restrictions on construction to avoid important spawning, feeding, and breeding seasons; and compensatory mitigation where impacts cannot be avoided or meaningfully reduced. Many commenters supported the idea of conducting baseline surveys for all resources prior to development to determine data gaps and having continuing monitoring throughout construction and operational activities. Commenters noted that because floating offshore wind structures use newer technology with less well-documented impacts, the effects on wildlife as a result of the structures should be studied prior to widespread implementation. Some also stated that data gaps remained in terms of the economics of affected communities and the effects of wind energy extraction on the ocean.

Commenters indicated they were opposed to offshore wind structures being placed within special aquatic resource areas such as Stellwagen Bank or other protected or environmentally sensitive marine areas and HMAs. Additionally, commenters requested BOEM carefully select proposed landfall and onshore infrastructure locations for future wind energy projects to protect coastal wetlands, biodiversity, and recreational access. Commenters were specifically opposed to the potential industrialization of Sears Island.

Because the potential Research Array would use newer technology, commenters recommended that potential future development of the Research Array inform new information, technologies, and operating procedures for future commercial offshore wind development in the Gulf of Maine. Commenters encouraged BOEM to ensure research activities help to understand how different wind turbine and substation platforms could benefit or affect the ecosystem and guide future mitigation strategies, as well as set a resolution standard for multibeam data collection so future data could be used more effectively to avoid vulnerable and sensitive habitats. A commenter asked BOEM to ensure the Proposed Action yields a large amount of essential data by verifying survey vessels would be managed by rigorous scientific standards, measuring data before and after turbines are operational, and ensuring survey and monitoring efforts are properly equipped and staffed. They also proposed various construction techniques and specific technology to be used, specifically requesting that the offshore wind platforms be equipped with a total inventory of oceanographic equipment to collect data, that before/after baselines be established, and that the primary purpose of the project be to investigate offshore wind effects on the marine environment.

Commenters voiced support for BOEM to take a cumulative approach to offshore wind leasing in the Gulf of Maine and to prepare an environmental impact statement prior to authorizing construction within the research lease to further analyze potential impacts.

BOEM Response to Comments

Impacts from the construction, installation, and operation of a full-scale wind energy facility are outside of the scope of analysis for the Proposed Action and are therefore not addressed in the EA. Additionally, the evaluation of the impacts of potential future commercial lease area locations on resources is outside the scope of analysis for this EA. The 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. The Proposed Action evaluated in this EA includes site assessment and site characterization activities within the Research Lease Area. The purpose of this EA is to identify potential effects on resources, including wildlife species, as a result of the Proposed Action and alternatives to inform BOEM's decision of whether to issue the research lease.

The analysis requested by commenters on the potential impacts of installation of wind energy research facilities and commercial wind energy development and on resources, such as the potential impacts of mooring line and wind turbine generator anchoring, would occur during subsequent NEPA analysis. Additional project-specific NEPA analysis would be required if a RAP is submitted for construction, operation, and decommissioning of the Research Array. Similarly, if a commercial lessee submits a Construction and Operations Plan, BOEM would initiate the preparation of a project-specific NEPA document that would analyze the impacts from the construction, installation, and operation of a commercial wind energy facility as described in the lessee's Construction and Operations Plan. This NEPA analysis would inform BOEM's decision to approve, approve with modifications, or disapprove the lessee's Construction and Operations Plan. Mitigation measures to avoid or minimize potential impacts on resources would be included in the NEPA analysis and developed through consultation with federal agencies and other consulting parties. As required by the Council on Environmental Quality NEPA Implementing Regulations, project-specific NEPA analysis is required to include an evaluation of cumulative effects.



U.S. Department of the Interior

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.



Bureau of Ocean Energy Management

The mission of the Bureau of Ocean Energy Management is to manage development of U.S. Outer Continental Shelf energy and mineral resources in an environmentally and economically responsible way. The bureau promotes energy independence, environmental protection, and economic development through responsible management of these offshore resources based on the best available science.