

Gulf of Maine Environmental Assessment

Wind Energy Research Lease on the Atlantic Outer Continental Shelf: Gulf of Maine Environmental Assessment Draft Biological Assessment

For the National Marine Fisheries Service
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**U.S. Department of the Interior
Bureau of Ocean Energy Management
Office of Renewable Energy Programs**



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List of Acronyms

Term	Definition
AIM	Acoustic Integration Model
AIS	Automatic Identification System
ALWTRP	Atlantic Large Whale Take Reduction Plan
AMAPPS	Atlantic Marine Assessment Program for Protected Species
ANSI	American National Standards Institute
ASMFC	Atlantic States Marine Fisheries Council
ASSRT	Atlantic Sturgeon Status Review Team
AUV	autonomous underwater vehicle
BIA	biologically important area
BMP	best management practice
BOEM	Bureau of Ocean Energy Management
BOEMRE	Bureau of Ocean Energy Management, Regulation, and Enforcement
BRI	Biodiversity Research Institute
BSEE	Bureau of Safety and Environmental Enforcement
CAA	Clean Air Act
CETAP	Cetacean and Turtle Assessment Program
CFR	Code of Federal Regulations
CSA	CSA Ocean Sciences Inc.
CWA	Clean Water Act
DFO	Fisheries and Oceans Canada
DMA	Dynamic Management Area
DMR	Maine Department of Marine Resources
DNREC	Department of Natural Resources and Environmental Control
DOI	Department of the Interior
DPS	Distinct Population Segment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIS	environmental impact statement
EMF	electromagnetic field
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FDR	Facility Design Report
FHWA	Federal Highway Administration
FHWG	Fisheries Hydroacoustic Working Group

Term	Definition
FIR	Fabrication and Installation Reports
GAR	Greater Atlantic Region
GARFO	Greater Atlantic Regional Fisheries Office
GMRI	Gulf of Maine Research Institute
GPS	global positioning system
HDD	horizontal directional drilling
HRG	high-resolution geophysical
IHA	Incidental Harassment Authorization
IPF	impact-producing factor
ITA	Incidental Take Authorization
IUCN	International Union for Conservation of Nature
LAA	likely to adversely affect
LFC	low-frequency cetacean
LOA	letter of authorization
MBES	multibeam echosounder
MFC	mid-frequency cetacean
MMPA	Marine Mammal Protection Act
MOA	memorandum of agreement
MOTUS	MOTUS Wildlife Tracking System
NARW	North Atlantic right whale
NASA	National Aeronautics and Space Administration
NEFSC	Northeast Fisheries Science Center
NEPA	National Environmental Policy Act
NLAA	not likely to adversely affect
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollution Discharge Elimination System
NPS	National Park Service
NRC	National Research Council
NROC	Northeast Regional Ocean Council
OCS	Outer Continental Shelf
OPR	Office of Protected Resources
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
OSS	offshore substation
PAM	passive acoustic monitoring

Term	Definition
PBR	potential biological removal
PIT	passive integrated transponder
PRD	Protected Species Division
PSO	protected species observer
PTOW	Pine Tree Offshore Wind
PTS	permanent threshold shift
RAP	Research Activities Plan
RHA	Rivers and Harbors Act
ROD	Record of Decision
SAG	surface active group
SAR	stock assessment report
SBP	sub-bottom profiler
SEFSC	Southeast Fisheries Science Center
SEL	sound exposure level
SMA	Seasonal Management Area
SPL	sound pressure level
SSS	side scan sonar
TBD	to be determined
TEWG	Turtle Expert Working Group
TIMS	Technical Information Management System
TSS	total suspended solids
TTS	temporary threshold shift
UHRS	ultrahigh-resolution seismic
UME	Unusual Mortality Event
USACE	U.S. Army Corps of Engineers
USC	United States Code
USCG	U.S Coast Guard
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UXO	unexploded ordnance
WEA	wind energy area
WHOI	Woods Hole Oceanographic Institute
WTG	wind turbine generator

1 Introduction

In accordance with Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 United States Code [U.S.C.] §§ 1531 et seq.), this document transmits the Bureau of Ocean Energy Management's (BOEM's) Biological Assessment (BA) of the effects of the Proposed Action on ESA-listed species and designated critical habitat that occur within the Action Area.

The Proposed Action for this BA is the issuance of a wind energy research lease within the Wind Energy Area (WEA) that BOEM has designated on the U.S. Outer Continental Shelf (OCS) in the Gulf of Maine, in support of wind energy development. The research lease would grant the State of Maine the exclusive rights to submit, for BOEM's potential approval, a research activities plan (RAP) for wind energy-related research activities offshore Maine. The research lease would not authorize any development or construction activities on the OCS; but would authorize site assessment activities (i.e., placement of a meteorological ocean buoy) on the lease, and site characterization activities (i.e., geophysical, geotechnical, biological, and archeological surveys and monitoring activities) in and around the lease and potential future project easements. The potential project easements would all be located within the Gulf of Maine and include corridors that extend from the lease area to the onshore energy grid.

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.

BOEM is the lead federal agency for purposes of Section 7 consultation (50 Code of Federal Regulations [CFR] 402.07); the other co-action agencies include the Bureau of Safety and Environmental Enforcement (BSEE) who is responsible for non-compliance and the National Marine Fisheries Service's Office of Protected Resources (NMFS OPR).

2 Consultation History and Regulatory Authorities

2.1 Consultation History

The Energy Policy Act of 2005, Public Law 109-58, added Section 8(p)(1)(c) to the Outer Continental Shelf Lands Act. This section authorized the Secretary of the Interior to issue leases, easements, and ROWs in the OCS for renewable energy development, including wind energy. The Secretary delegated this authority to the former Minerals Management Service, and later to BOEM. Final regulations implementing this authority (30 CFR part 585) were promulgated on April 22, 2009.

On October 1, 2021, the State of Maine submitted an application for a research lease requesting 9,700 acres (3,925.5 hectares) on the U.S. Outer Continental Shelf in a location more than 20 nmi (37 km) off the Maine coast. On August 19, 2022, BOEM published a Request for Competitive Interest for the Gulf of Maine in the *Federal Register (FR)* for a 45-day public comment period, and a separate Request for Interest was published on that same date. On January 19, 2023, BOEM announced its “Determination of No Competitive Interest” for a research lease proposed by the State of Maine. BOEM’s determination means that the bureau will move forward to process the state’s research application, which could be used to inform any future commercial offshore wind development in the Gulf of Maine. Subsequently, BOEM announced the publication of the Gulf of Maine’s Notice of Intent to prepare an Environmental Assessment (EA) for a wind energy research lease on the Atlantic OCS offshore Maine in the *FR* on May 3, 2023.

This BA is being submitted to support BOEM’s request for initiation of ESA Section 7 consultation. The target date for submittal to NMFS for review is July 21, 2023, in coordination with BSEE. The request for Section 7 consultation includes BOEM’s approval of the State of Maine’s research lease application. BOEM has ensured that the final BA has been reviewed by the other action agencies and it includes all the information required by 50 CFR 402.14(c).

2.2 Other Regulatory Authorities

2.2.1 Bureau of Safety and Environmental Enforcement

BSEE’s mission is to enforce safety, environmental, and conservation compliance with any associated legal and regulatory requirements during the proposed surveys and future activities. BSEE is responsible for verifying and enforcing compliance with any conservation measures from this consultation for activities conducted on the OCS. Additionally, BSEE will be the lead agency for the review and approval of the Facility Design Report (FDR) and Fabrication and Installation Reports (FIR) and will oversee inspections and enforcement actions, as appropriate; closeout verification efforts; facility removal inspections/monitoring; and bottom-clearance confirmation.

2.2.2 United States Army Corps of Engineers

The USACE regulates discharges of dredged or fill material into U.S. waters and structures or work in navigable waters of the U.S. under Section 404 of the CWA and Section 10 of the RHA. Such work includes construction of offshore wind turbine generators (WTGs), scour protection around the base of WTGs, Offshore substations (OSSs), inter-array cables connecting WTGs to the OSSs, offshore export cables, port improvements, dredging, and other activities subject to USACE approval. The USACE intends to utilize this BA to meet its responsibilities under Section 404 of the CWA and Section 10 of the RHA. Under the Proposed Action, a Pre-Construction Notice with the USACE will be pursued prior to

installation of the floating light detection and ranging (FLiDAR) buoy (Section 3.1.1.1) and MOTUS Wildlife Tracking System (Section 3.1.2.10); and prior to starting the high-resolution geophysical (HRG) survey activities (Section 3.1.2.2), the geotechnical survey activities (Section 3.1.2.3), and benthic survey activities (Section 3.1.2.4). Section 10 permits may also be pursued for the Bottom Trawl Surveys (Section 3.1.2.12).

2.2.3 United States Coast Guard

The USCG administers the permits for PATON located on structures positioned in or near navigable waters of the U.S. All project vessels will be 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). Additionally, a PATON permit will be pursued prior to installation of the FLiDAR buoy (Section 3.1.1.1) and MOTUS Wildlife Tracking System (Section 3.1.2.10).

2.2.4 United States Environmental Protection Agency

The OCS Air Regulations (40 CFR part 55) establish the applicable air pollution control requirements, including provisions related to permitting, monitoring, reporting, fees, compliance, and enforcement, for facilities subject to Section 328 of the Clean Air Act (CAA). Section 328 of the CAA requires that OCS sources located within 25 mi (40 km) of States' seaward boundaries submit a Notice of Intent (NOI) and apply for an OCS air permit to construct and operate the OCS source in accordance with the requirements of the Corresponding Onshore Area. In addition, Section 328 of the CAA creates a more comprehensive program for sources within States' seaward boundaries, stating: "Such requirements shall be the same as would be applicable if the source were located in the corresponding onshore area, and shall include, but not be limited to, State and local requirements for emission controls, emission limitations, offsets, permitting, monitoring, testing, and reporting."

The USEPA may also require, or delegate authority to Maine state agencies, a National Pollutant Discharge Elimination System (NPDES) general permit if there is regulated discharge of pollutants into waters of the U.S. NPDES general permits are issued under Section 402 of the CWA (33 U.S.C. 1342 et seq.) to authorize routine discharges by multiple dischargers.

2.2.5 National Marine Fisheries Service

The MMPA, as amended, and its implementing regulations (50 CFR part 216) allow, upon request, the incidental take of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographic region. Incidental take is defined under the MMPA (50 CFR 216.3) as, "harass, hunt, capture, collect, or kill, or attempt to harass, hunt, capture, collect, or kill any marine mammal. This includes, without limitation, any of the following: the collection of dead animals, or parts thereof; the restraint or detention of a marine mammal, no matter how temporary; tagging a marine mammal; the negligent or intentional operation of an aircraft or vessel, or the doing of any other negligent or intentional act which results in disturbing or molesting a marine mammal; and feeding or attempting to feed a marine mammal in the wild." The "take" largely arises due to activities incidental to planned marine construction activities, such as underwater sound, and may include behavioral avoidance. For the Proposed Action, Incidental Harassment Authorization (IHA) under the MMPA will be requested for the high-resolution geophysical (HRG) survey, geotechnical survey, and benthic survey activities which use equipment operating at frequencies <180 kHz (Sections 3.1.2.2, 3.1.2.3, and 3.1.2.4).

3 Description of the Proposed Action and Action Area

Under the ESA, “action” means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies in the U.S. or upon the high seas (50 CFR 402.02). The Proposed Action for this BA is the issuance of a lease and the associated site assessment activities on the lease and site characterization activities on the lease, and potential Project easements and is discussed in **Section 3.1**. The Action Area is defined in **Section 3.2**. Finally, all monitoring and mitigation measures that are included within the Proposed Action are presented in **Section 3.3**.

Unless otherwise noted, the region in which all site assessment and site characterization surveys (e.g., benthic, fisheries, biological, geophysical reconnaissance, HRG, aerial) will occur encompasses the Research Lease Area, potential cable routes, and the wet storage area in Penobscot Bay. The majority of vessel transits will originate from ports along coastal Maine.

3.1 Description of Activities

The Proposed Action is the issuance of a lease and the resultant site assessment activities on the lease and site characterization activities on the lease and potential Project easements. Site assessment activities may include the temporary placement of a meteorological ocean buoy. Site characterization activities may include geophysical, geotechnical, biological, and archeological surveys and monitoring activities. The following subsections provide more detail regarding the activities considered in this BA.

3.1.1 Site Assessment Activities

Site assessment activities under the Proposed Action will include deployment of a FLiDAR buoy and associated vessel activity for its deployment, maintenance, and retrieval as described in the following subsections.

3.1.1.1 Floating Light Detection and Ranging Buoy Deployment

Pine Tree Offshore Wind (PTOW) will deploy a Fugro SEAWATCH Wind 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, providing both project data and also alerting the project to the need for maintenance if systems appear to be collecting erroneous information (or no information at all). The FLiDAR will be equipped with an independent tracker and dual global positioning system (GPS) to allow for real-time position monitoring. Power to the FLiDAR will be supplied and charged by solar panels and the backup buoy power system. Backup energy needed to operate the requested sensors autonomously will be provided by methanol fuel cells in the hull.

The FLiDAR buoy diameter is 9.5 ft (2.9 m), with an overall height of 23 ft (6.8 m), and approximate weight of 5,512 lb (2,500 kg). The bottom anchor is estimated to be approximately 6,000 lb (2,722 kg) and is not expected to exceed a footprint of 32 ft² (3 m²). The buoy will be deployed within the Research Lease Area and moored with a single gravity-based anchor in which the anchor is laid on the seafloor and settles due to gravity pulling the weight down. An overview of the FLiDAR buoy parameters is provided in **Table 3-1**.

Table 3-1. Summary of key components of the FLiDAR buoy system under the Proposed Action

Parameter	Details
FLiDAR buoy dimensions	Diameter = 9.5 ft (2.9 m) Height = 23 ft (6.8 m) Weight = 5,512 lb (2,500 kg)
Anchor	6,000 lb (2,722 kg) bottom anchor
Anchor type	Gravity-based
Maximum seafloor disturbance	32 ft ² (3 m ²)
Timing of deployment	June 2023 through June 2025

FLiDAR = floating light detection and ranging buoy

3.1.1.2 Vessels and Potential Ports

Deployment of the FLiDAR buoy (**Section 3.1.1.1**) may require up to four total vessel trips for deployment, maintenance (2 trips), and decommissioning. The buoy deployment is anticipated to be 24-months (March 2024 through February 2026). An overview of the vessel activities associated with the proposed site assessment activities is provided in **Table 3-2**.

Table 3-2. Estimated Proposed Action vessel use during site assessment activities

Vessel Type	Vessel Length	Home Port	Number of Vessels	Number of Round Trips per Year		
				2024	2025	2026
Crew Boat	200 ft (61 m)	Boston, MA or Portland, ME	1	1	2	1

3.1.2 Site Characterization Activities

Site characterization activities under the Proposed Action would occur in the Action Area and include geophysical reconnaissance surveys; HRG surveys; geotechnical surveys; benthic surveys; seafloor habitat characterization sampling and surveys; physical oceanographic monitoring; digital aerial surveys; visual wildlife surveys; passive acoustic monitoring (PAM) of marine mammals, ambient noise, and large pelagic and benthic fish; MOTUS tracking; active acoustic surveys, environmental DNA (eDNA) sampling of marine fish and invertebrates; bottom trawl surveys for marine fish and invertebrates; plankton and larval lobster surveys; lobster trawl surveys; gillnet surveys; and associated vessel traffic. A description of these activities is provided in the following subsections.

3.1.2.1 Geophysical Reconnaissance Surveys

PTOW will conduct geophysical reconnaissance surveys within the Research Lease Area, 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 HRG surveys. The surveys will utilize hull-mounted multibeam echosounder (MBES) with backscatter measurement (proxy for seafloor hardness) and a sub-bottom profiler (SBP). The selected equipment will have operational frequencies greater than 180 kHz or operate at amplitudes and beamwidths such that Incidental Harassment Authorization (IHA) for marine mammals will not be required. Geophysical reconnaissance surveys will occur between September 2023 and November 2023 and will include both 24-hour and 12-hour operations. It is anticipated that the 24-hour survey operations will require 15 multi-day trips that would each be approximately 7 to 14 days depending on many factors,

including weather downtime, vessel replenishment, and crew changes. The 12-hour operations will require 60 daily vessel trips during the survey period.

3.1.2.2 HRG Surveys

HRG surveys will be conducted in the Research Lease Area, potential export cable routes, and wet storage area identified in the State of Maine's research lease application (**Figure 3-2**). 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 archeological resources. Surveys will utilize MBES, side-scan sonar (SSS), SBP, magnetometer, and ultrahigh-resolution seismic (UHRS) imaging equipment. The proposed SBP profiler equipment will likely include parametric systems (e.g., Innomar system) with operational frequencies between 30 and 115 kHz. Surveys will occur between March and October 2024 and will include both 24-hour and 12-hour operations. It is anticipated that the 24-hour survey operations will require 15 multi-day trips that would each be approximately 7 to 14 days depending on many factors, including weather downtime, vessel replenishment, and crew changes. The 12-hour operations will require 60 daily vessel trips during the survey period.

3.1.2.3 Geotechnical Surveys

The 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 would sample or test seabed characteristics to inform design specifications of and locations suitable for placement of anchors and cable infrastructure. Equipment used for these surveys will include shallow geotechnical coring (piston or vibracores) and cone penetration testing. The exact scope of these surveys has not yet been determined but it is anticipated that several hundred vibracores and cone penetration testing samples will be required throughout the survey area (**Figure 3-1**) and survey period. Each sample would result in minimal seafloor disturbance, on the order of several square meters in disturbance area. It is anticipated that up to 30 multi-day trips which will each be approximately 7 to 14 days depending on many factors, including weather downtime, vessel replenishment, and crew changes will be required for these surveys between March and October 2024.

3.1.2.4 Benthic Surveys

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 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 (**Figure 3-2**). The surveys will utilize benthic grabs (Hamon grab or Van Veen grab), sediment profile imaging/plan view cameras, and underwater video. The exact scope of these surveys has not yet been determined but it is anticipated that several hundred benthic samples will be required throughout the Action Area (**Figure 3-2**) and survey period. Each sample would result in minimal seafloor disturbance, on the order of several square meters in disturbance area. It is anticipated that the benthic survey vessel which will undergo up to 30 multi-day trips will span approximately 7 to 14 days between September and October 2023 and these surveys will be conducted in tandem with the geophysical and geotechnical survey activities described previously.

3.1.2.5 Seafloor Habitat Characterization Sampling and Surveys

The Maine Department of Marine Resources (DMR) will conduct sampling and surveys of the Research Lease Area, potential export cable routes, and wet storage area identified in the State of Maine's research lease application to characterize seafloor habitat and benthic infauna species composition. Data collected would include water column profiles; average seafloor values for temperature, pH, chlorophyll, dissolved

oxygen, and salinity; surficial sediment information; seafloor video; benthic species composition; bathymetry; and backscatter. Seafloor sampling and surveys will utilize benthic grab equipment and MBES. These surveys will be conducted once per year beginning in the First Quarter of 2023 and continuing until the RAP is approved.

3.1.2.6 Physical Oceanographic Monitoring

DMR will conduct monitoring to characterize the physical oceanographic conditions and surface wind conditions in and around the Research Lease Area (**Figure 3-1**). Above-water and surface data will be collected from existing shore-based radar stations with 3.1-mi (5-km) resolution operated by the State of Massachusetts, and two additional radar stations with 1.2-mi (2-km) resolution will also 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. Monitoring from the shore-based radar stations would occur continuously, while the underwater gliders would be deployed monthly or less frequently depending on data needs. Data collection will begin in July of 2023 and continue until the RAP is approved. These survey activities will require a license from the Federal Communications Commission (FCC) for the radar which will be authorized through Woods Hole Oceanographic Institute, and a Special Activities Permit from the Maine Bureau of Parks and Lands.

3.1.2.7 Digital Aerial Surveys

PTOW will work with HiDef and Biodiversity Research Institute (BRI) to conduct high-definition digital aerial surveys of the Action Area (**Figure 3-2**) to sample and map seasonal occurrence and activity of birds (as well as bats, marine mammals, sea turtles, and large fish). Surveys will also document the number of individuals, distribution, behaviors (e.g., foraging, flying, resting), and flight height and direction (if applicable). The surveys will use high-resolution digital video cameras will be mounted on a fixed-wing aircraft flying at an altitude of approximately 1,312 ft (400 m) and ground speed of approximately 137 mph (220 kph or 120 kn), providing imagery at 0.6 in (1.5 cm) ground sample distance. Initially, surveys would cover the entire Research Lease Area, but may be reduced to cover lease area plus a 2.5-mi (4-km) buffer.

BOEM has funded four broad digital surveys (once per season) to be conducted by HiDef and BRI starting in the Spring of 2023. To meet BOEM's Avian Survey Guidelines, PTOW aims to conduct a total of 12 surveys (one per month) in the Action Area (**Figure 3-2**) starting in April 2023. Four surveys will be flown alongside the BOEM surveys, and eight will be standalone surveys. By flying additional interlaced transects, spaced evenly between the existing BOEM transects, these surveys will provide approximately 15% cover of the Research Lease Area, plus a 3-mi (4-km) buffer. The BOEM Guidelines require greater than 10% coverage, and due to the small survey area, and the limited flexibility in transect spacing, this coverage represents the most efficient way to accomplish this objective.

3.1.2.8 Visual Wildlife Surveys

Visual wildlife surveys will be conducted by BRI, in cooperation with the Gulf of Maine Research Institute (GMRI) to assess marine mammal, bird, and sea turtle species utilization of the Research Lease Area (**Figure 3-1**), with emphasis on endangered and threatened species under the ESA. The surveys will also assess information variability and uncertainty associated with baseline surveys. All observers will 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. Surveys will 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. Vessel speeds will not exceed 11.5 mph (18.5 kph or 10 kn). The number of trips for this survey will depend on the final vessel type and port locations selected but are anticipated to begin in 2023 and continue until the RAP is approved.

3.1.2.9 PAM for Marine Mammals, Ambient Noise, and Large Pelagic and Benthic Fish

DMR will conduct passive acoustic monitoring to characterize marine mammal utilization of the Research Lease Area (**Figure 3-1**) and to quantify levels of ambient noise. The mooring suites would be spaced across the Research Lease Area and vicinity to incorporate into a larger network across the Gulf of Maine used for location and tracking work. DMR will also opportunistically tag fish with passive acoustic tags to characterize seasonal distribution, movement patterns, and habitat use of highly migratory (e.g., tuna, sharks) and benthic (e.g., cod, hake, haddock, redfish, dogfish) fishes. Pop-up satellite archival tags (PSATs) 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.

Acoustic data for marine mammals and ambient noise levels will be collected using nine SoundTrap ST600 hydrophones equipped with F-POD devices. Recorded data will be analyzed for all whale calls, especially the presence of North Atlantic right whale (NARW) calls, with a primary focus on their 100 to 300 Hz upcalls. The hydrophones will sample at a rate of 48 kHz which equates to an effective analysis range of up to 24 kHz. The F-PODs enable detection of odontocete (toothed whale) species with core detection bands generally under 140 kHz. There is no surface connection to the SoundTrap systems; all equipment is bottom mounted with no vertical lines to the surface.

For the large pelagic and benthic fish monitoring, 15 Vemco VR2AR Receivers will be moored with custom weights and floated approximately 50 ft (15 m) above the seafloor to detect tags. Each receiver would be equipped with an acoustic release, eliminating the use of vertical lines that may pose risks to marine mammals and turtles. Pop-up satellite archival tags (PSATs) do not require detection by the acoustic array and would pass data via a satellite link at a pre-selected time.

The number of trips for the PAM data collection surveys will depend on the final vessel selections and port locations, but it is anticipated that the hydrophones for the marine mammal and ambient noise data collection will be deployed starting in July 2023 and continue through RAP approval, while the fish data collection equipment will be deployed beginning in the Third Quarter of 2022 and continue through RAP approval.

3.1.2.10 MOTUS Tracking

MOTUS is an international collaborative network established by researchers that have tagged birds and bats with automated radio telemetry tags. A MOTUS Wildlife Tracking System-compatible receiver station will be deployed on the FLiDAR buoy (**Section 3.1.1.1**) to provide data on the occurrence of tagged birds or bats in the Research Lease Area (**Figure 3-2**) coupled with information on the season, time of day, and weather conditions. MOTUS data are typically limited to what birds or bats may be tagged and may occur in the Action Area during the FLiDAR buoy offshore deployment. The receiving station will operate at a common frequency compatible with other MOTUS installations in the region. It is expected that the MOTUS tracking system will be deployed for 24-months (March 2024 through February 2026) as part of the FLiDAR buoy deployment period.

3.1.2.11 Active Acoustic Surveys and eDNA Sampling of Marine Fish and Invertebrates

Gulf of Maine Research Institute would conduct active acoustic surveys along fixed transects in the Research Lease Area and vicinity to evaluate marine fish, particularly small pelagic species, and

invertebrate species and taxon abundance and distribution in the water column and in proximity to the benthos. A Simrad EK60 echosounder system with three split-beam transducers (38, 120, and 200 kHz) will be the active acoustic equipment utilized for these surveys. Water samples will be collected with a General Oceanics Niskin Water Sampler and run through eDNA analysis that will be used to ground truth the acoustic data. It is anticipated that these surveys will require one 12-hour vessel survey day per month beginning in September 2022 through to approval of the RAP.

3.1.2.12 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 to 38 tows would be conducted within and up to 12 nmi (22 km) outside of the Research Lease Area (**Figure 3-1**). Surveys would not be conducted under regular commercial fishing. Protocols and equipment will be consistent with those used for the Maine-New Hampshire Inshore Trawl Survey (Sherman et al. 2005) for sorting, weighing, and measuring protocols. Net metric data will be collected at each tow to ensure the net is fishing comparably at each location. Survey equipment will consist of a 57 to 70-ft (17 to 21-m) modified shrimp trawl net with Thyborøn™ type 25 THYson trawl doors approximately 21 ft² (2 m²) in size, weighing 606 lb (275 kg) each, and towed at a speed of 2.9 mph (4.6 kph or 2.5 kn). It is anticipated that 1 to 6 vessel trips will be conducted seasonally, beginning as soon as September 2023 and continuing for up to 2 years or until the RAP is approved. These surveys will require a Maine Special License prior to commencement.

3.1.2.13 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 nmi (5.6 km) outside of the Research Lease Area. Surveys would not be conducted under regular commercial fishing. Vertical tows will follow the Department of Fisheries and Oceans Canada's Atlantic Zone Monitoring Program protocols (Mitchell et al. 2002) and the neuston tows will follow DMR's larval survey protocol (DMR 2022a). Selection of survey locations will consider seasonal wind patterns in order to establish a baseline to examine potential impacts on stratification downstream from potential future turbine installations. Surveys are anticipated to begin in July 2023 and continue until the RAP is approved.

3.1.2.14 Lobster Trawl Surveys

DMR would conduct lobster surveys to characterize the lobster population, including the presence of large egg-bearing and oversized lobsters, to assess movement patterns of lobsters, and to test ropeless fishing gear. Traps will be set within and up to 12 nmi (22 km) outside the Research Lease Area and hauled three times per quarter. Surveys would not be conducted under regular commercial fishing. Trawls will be equipped with 12 traps, alternating vented and ventless, and will be set with one regular endline and one ropeless fishing unit. The exact gear specifications will be determined based on conversations with industry members. These surveys are anticipated to begin in September 2023 and continue for up to 2 years or until approval of the RAP. These surveys will require a Maine Special License prior to commencement.

3.1.2.15 Gillnet Surveys

PTOW would conduct gillnet surveys to sample fish populations each season within the Action Area. It is anticipated up to 20 to 30 trawls would be conducted within and around the Research Lease Area using gillnet mesh and net sizes determined based on input from local fishermen. Surveys would not be conducted under regular commercial fishing. These surveys are anticipated to include 6 vessel trips per

quarter beginning in September 2023 and continue for up to 2 years or until approval of the RAP. These surveys will require a NMFS Exempted Fishing Permit.

3.1.2.16 Vessels and Potential Ports

The potential types, number of transits, and home ports for vessel activities associated with the proposed site characterization activities described in the previous subsections is summarized in **Table 3-3**. The information in this table represents the best estimate of potential vessels transiting throughout the Action Area for the site characterization surveys included under the Proposed Action.

Table 3-3. Estimated Proposed Action vessel use during site characterization activities

Vessel Type	Approx. Vessel Length	Home Port	Number of Vessels	Timing	Total Number of Round Trips	Frequency of Transits
Geophysical reconnaissance 24-hour vessel	164 ft (50 m)	Portland, ME	1	September–November 2023	15	Multi-day trips
Geophysical reconnaissance 12-hour vessel	49 ft (15 m)	Portland, ME	1	September–November 2023	60	Daily
HRG survey 24-hour vessel	164 ft (50 m)	Portland, ME	1	March–October 2024	15	Multi-day trips
HRG survey 12-hour vessel	49 ft (15 m)	Portland, ME	1	March–October 2024	60	Daily
Geotechnical survey vessel	246–262 ft (75-80 m)	Portland, ME	1	March–October 2024	30	Multi-day trips
Benthic survey vessel	See GP reconnaissance and GT survey vessels	Portland, ME	1	September–October 2023	30	Multi-day trips
Research vessel for seafloor habitat sampling/surveys	45 ft (14 m)	Boothbay, ME	1	Q1 2023 – RAP approval ¹	30	Annual
Research vessel for physical oceanographic monitoring	45 ft (14 m)	Boothbay, ME	1	Q1 2023 – RAP approval ¹	63	Monthly ²
Crew boat	65 ft (19 m)	Portland, ME	1	2024 – RAP approval ¹	114	Monthly
Research vessel for PAM surveys	45 ft (14 m)	Boothbay, ME	1	Q3 2022 – RAP approval ¹	483	TBD ³
R/V <i>Merlin</i>	37 ft (11 m)	Portland, ME	1	September 2022– RAP approval ¹	73	Monthly

Vessel Type	Approx. Vessel Length	Home Port	Number of Vessels	Timing	Total Number of Round Trips	Frequency of Transits
Stern rigged single screw bottom trawler	70 ft (21 m)	Boothbay, ME	1	September 2023– RAP approval ¹	122	Seasonally ⁴
Research vessel for plankton and larval surveys	45 ft (14 m)	Boothbay, ME	1	July 2023 – RAP approval ¹	126	Monthly ⁵
Commercial lobster boat, single screw	50 ft (15 m)	Bristol, ME	1	September 2023 – RAP approval ¹	122	Quarterly
Commercial fishing vessel, single screw	50–75 ft (15– 21 m)	Portland, ME	1	September 2023 – September 2025	50	Quarterly

¹ This BA makes the conservative assumption that the RAP would be approved within 5 years of lease issuance, or approximately September 2028.

² Monthly vessel transits for physical oceanographic monitoring activities may be required for deployment of the underwater glider; however, deployment of the glider may occur less frequently based on data needs. For the purposes of this BA, the maximum-case scenario of one deployment per month was assumed in the determination of effects in **Section 6**.

³ Number and frequency of transits for the PAM surveys will depend on vessel availability as well as PAM equipment mooring maintenance requirements and the number of tags/receivers deployed in large pelagic and benthic fish.

⁴ Bottom trawl surveys may include one to six vessel trips per season depending on final port location and vessel availability; therefore, for the purposes of this BA, the maximum number of potential trips assuming six vessel trips per season was used in the analysis.

⁵ During the first year of plankton and larval surveys after lease issuance, one or two vessel trips per month is anticipated, and in subsequent years, the number of tips will depend on contracted vessels. For the purposes of this BA, it was assumed up to two vessel trips per month will be required for the duration of these surveys.

3.2 Action Area

The Action Area (**Figure 3-1**) is defined by 50 CFR 402.02 as “all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action.” The Action Area for this consultation is a broad region that encompasses the area where all Project activities will occur, inclusive of all site assessment and site characterization surveys (e.g., benthic, fisheries, biological, geophysical reconnaissance, HRG, aerial) as well as all vessel transit routes for all Project-related activities. The Action Area, as defined, includes the entire Research Lease Area, the area encompassing all potential cable routes, the wet storage area in Penobscot Bay, and ports located from Plymouth, Massachusetts to Stonington, Maine. No vessel transits from ports outside of this region are considered under the Proposed Action. A geographic overview of the Action Area is provided in **Figure 3-1**. The State of Maine’s requested lease area falls within the Research Lease Area and is identified in **Figure 3-2**.

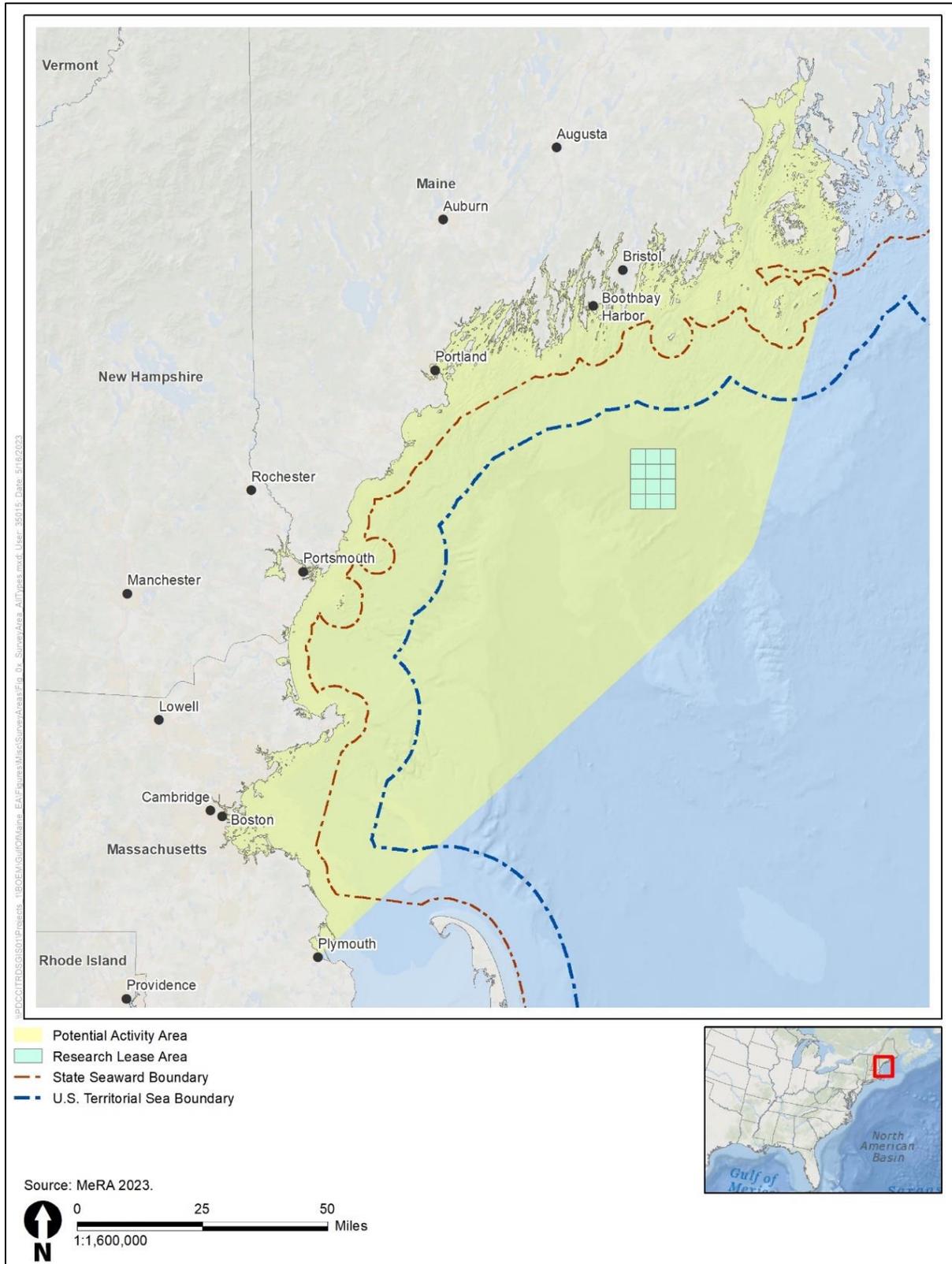


Figure 3-1. Action Area for the Proposed Action

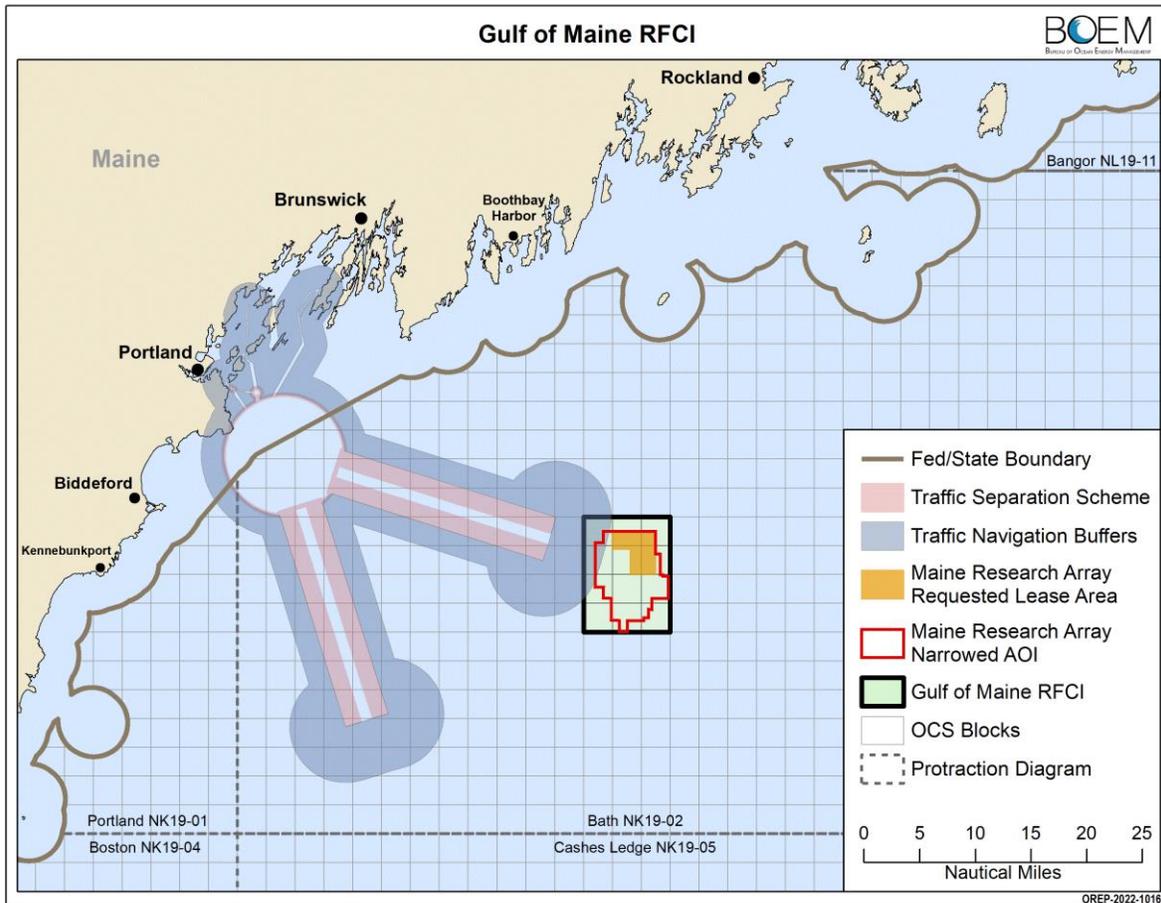


Figure 3-2. State of Maine’s requested lease area

3.2.1 Environmental Baseline Conditions Within the Action Area

3.2.1.1 Ecoregion

The Gulf of Maine is the northernmost component of the Northeast Large Marine Ecosystem. It is considered a semi-enclosed sea, bounded by Maine, New Hampshire, Massachusetts, New Brunswick, and Nova Scotia. Its complex geological, bathymetric, and oceanographic features support high levels of primary and secondary productivity, making it one of the most productive regions of all the world’s oceans (Thompson 2010). Cold and nutrient-dense Scotian Shelf waters from the Labrador Current enter the Gulf of Maine through the Northeast Channel, which sets up a generalized counterclockwise circulation that is bounded by Georges Bank to the south; Maine Coastal Current waters exit via the Great South Channel (Thompson 2010). Tidal-driven mixing is pronounced in the Gulf of Maine, especially in the Bay of Fundy. These features of the Gulf of Maine sustain high levels of biodiversity; the waters are used seasonally and year-round by a number of ESA-listed marine species and other species of commercial, economic, and cultural value. However, the Gulf of Maine is particularly vulnerable to rapidly changing conditions as a result of global climate change, as discussed in **Section 3.2.1.1.9**.

3.2.1.2 Seabed Conditions

Sediment from the coastline of the Action Area to roughly 295 ft (90 m) water depth is generally rocky with sand and gravel deposits. Muddy sediment deposits are also observed over large areas. High relief features exist beyond 9 nmi (16.7 km) from the coastline (Burgess 2022). The predominant sediment type within the Research Lease Area is silt (0.002 to 0.06 mm). This area is generally flat with depressions and slopes, with water depths ranging from 518 to 620 ft (158 to 189 m) (Pentony 2022).

The Maine Coastal Mapping Initiative routinely conducts surveys within the Gulf of Maine since 2015 (Benson and Enterline 2021; Dobbs 2017). The surveys conducted in 2015 and 2016 encompassed or were nearby to the Proposed Research Lease Area and covered approximately 57 mi² (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% of the samples containing more than 20% sand and 51% predominantly sand, according to Folk classifications. The samples nearshore at a depth of 164 ft (50 m) or less generally had the greatest sand concentration (Dobbs 2017). Gravel-sized particles were also common in the southern and eastern regions of the author's survey area in depths ranging from 98 to 164 ft (30 to 50 m) and comprised an average of 11% by weight in all the samples (Dobbs 2017).

Nearshore habitats include shallow water estuaries and bays which are mostly soft bottom sediments but also include shellfish beds and submerged aquatic vegetation (SAV). 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 (Stevenson et al. 2014; Kritzer et al. 2016). Stevenson et al. (2014) evaluated the importance of these nearshore habitats for 16 of the most common commercially important species and their prey. Their analysis showed that sand and gravel/cobble habitats are used by 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.

3.2.1.3 Water Column Conditions

The Maine Department of Environmental Protection, Marine Environmental Monitoring Program was established in 1991 to monitor the “extent and effect of industrial contaminants and pollutants on marine and estuarine ecosystems and to determine compliance with and attainment of water quality standards” (38 Maine Revised Statutes 410-F). The State has three water quality classes for marine and estuarine waters—SA, SB, and SC—listed in order from highest to lowest quality (38 Maine Revised Statutes 465-B). Classification is based on monitoring of ambient water quality, nutrients, and eutrophication indicators. The majority of marine and coastal waters are classified as SB, with intermittent areas along less-developed portions of the Gulf of Maine coastline and islands classified as SA (highest quality); and localized areas at the outlets of industrialized or nutrient-rich watersheds classified as SC (lowest quality) (Maine Department of Environmental Protection 2023).

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

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

3.2.1.4 Underwater Noise

Ambient noise in the Gulf of Maine based on a recorder deployed offshore Bar Harbor, Maine from August 1 to 31, 2008, was estimated to have some of the lowest overall noise levels compared to the other recording sites along the U.S. East Coast (Rice et al. 2014). The long-term spectral averages showed regular low-frequency pulses throughout the recording period which were thought to be related to tidal flow noise (Rice et al. 2014). The highest sound energy was reported between 10 and 200 Hz with cumulative equivalent sound levels, calculated as the variation in sound levels as a function of time, for the entire recording period exceeded 105 decibels (dB) referenced to (re) 1 micropascal (μ Pa) less than 1% of the time, whereas 50% of the data throughout the recording period only exceeded a median of 84 dB re 1 μ Pa (Rice et al. 2014). On average, sound levels in the Gulf of Maine during this one month recording period exceeded 120 dB re 1 μ Pa, the behavioral disturbance threshold for marine mammals in response to non-impulsive continuous sources (**Section 6.3.1.1**), less than 10% of the time (Rice et al. 2014).

NOAA's NEFSC has deployed multiple recorders within the Gulf of Maine including a moored SoundTrap 500 located in 61 m water depth just south of the island of Monhegan, Maine, offshore Muscongus Bay in the northern part of the Action Area which collected data between February and December 2021; multiple marine acoustic recording units (MARU) deployed over Tillies Bank and Jeffreys Ledge just north of Stellwagen Bank National Marine Sanctuary in 60 to 133 m water depth which collected data between December 2007 and March 2010; and multiple MARU deployed within Stellwagen Bank National Marine Sanctuary in 25 to 81 m water depth which collected data between September 2008 and November 2009 (NOAA National Centers for Environmental Information [NCEI] 2023). Most of these studies collected animal detection information and no ambient noise levels were reported from any of these recorders, but raw data files are available that could be potentially be mined for ambient noise levels (NOAA NCEI 2023).

Haver et al. (2018) used data from recorders deployed by NOAA and the National Park Service (NPS) around the U.S., one of which was deployed in the Northeastern U.S. along the continental shelf edge is approximately 2,953 ft (900 m) water depth. Data collected from July 2014 to March 2015 showed sound spectrum levels ranging from approximately 60 dB re 1 μ Pa²/Hz at 1,000 Hz to 100 dB re 1 μ Pa²/Hz at 18 Hz. The peaks in sound levels observed around 18 Hz were thought to be indicative of fin and blue whale vocalizations in the data (Haver et al. 2018). The patterns in the ambient noise levels at all the different sites analyzed by Haver et al. (2018) were thought to reflect proximity to populated port cities and shipping lanes which influenced the level of vessel traffic in the region, which was reflected by the relatively higher noise levels observed in the Northeastern U.S. recording site. However, it is worth noting that this analysis focused on data in deep water beyond the shelf edge so data from the Stellwagen Bank recorder was not selected and these result therefore represent noise conditions for waters deeper than what would be expected to occur in the Action Area.

Haver et al. (2019) used data from similar recorders analyzed by Haver et al. (2018) but focused specifically on comparison of underwater soundscapes for U.S. National Parks and Marine Sanctuaries, including Stellwagen Bank National Marine Sanctuary which falls within the Action Area (**Figure 3-1**). Results of this analysis showed sound levels in the 50 Hz to 1.5 kHz frequency band were lower in Stellwagen Bank between June – August compared to November – May, thought to be correlated with lower wind speeds during the summer. The data collected in this area also showed numerous, high-noise transient events thought to be vessel passages through the area (Haver et al. 2019). The 90th, 5th, and 10th percentiles of the sound levels all peaked at 20 Hz with sound levels ranging from approximately 70 to 105 dB re 1 μ Pa²/Hz at this frequency (Haver et al. 2019).

Haxel et al. (2022) deployed a hydrophone in a free drifting configuration at a 25-kW rated tidal turbine at the University of New Hampshire's Living Bridge Project in Portsmouth, New Hampshire. This project uses existing infrastructure of the Memorial Bridge connecting motor vehicle and pedestrian traffic between Portsmouth, New Hampshire, and Kittery, Maine, over the tidal Piscataqua River in Great Bay Estuary, roughly 4 km upriver from the Gulf of Maine. Data were collected between 21 and 23 July 2021 with the hydrophone deployed 1.6 m below the water's surface. The deployment method and timing were selected to align with the large possible range of the tidal turbine's generator outputs (Haxel et al. 2022). SPL ranged from approximately 105 to 125 dB re 1 μ P but the authors noted that a comparisons of measured sound levels with proximity to the turbine did not reveal any clear patterns in noise levels associated with the turbine, nor was any repeated, characteristic turbine signal observed above the background ambient acoustic conditions (Haxel et al. 2022). Increases in SPL observed approximately 50 to 60 m downstream of the tidal turbine were thought to be attributed to passing vessels or noise related to the bridge from which the tidal turbine is deployed (Haxel et al. 2022).

3.2.1.5 Electromagnetic Field

The marine environment continuously generates ambient electromagnetic field (EMF) effects. The motion of electrically conductive seawater through Earth's magnetic field induces voltage potential, thereby creating electrical currents. Surface and internal waves, tides, and coastal ocean currents all create weak, induced EMF effects. Their magnitude at a given time and location depends on the strength of the prevailing magnetic field, site, and time-specific ocean conditions. Other external factors such as electrical storms and solar events can also generate variable EMF effects. The strength of Earth's direct current (DC) magnetic field is approximately 517 milligauss (mG) (51.7 microteslas [μ T]) in the vicinity of the Lease Area (NOAA n.d.). This is the static magnetic field of Earth oriented to magnetic north at a declination of approximately 15 degrees west (NOAA n.d.). As ocean currents and organisms move through this DC magnetic field, a weak DC electric field is produced. For example, the electric field generated by the movement of the ocean currents through Earth's magnetic field is reported to be approximately 0.075 millivolts per meter (mV/m) or less (CSA Ocean Sciences Inc. and Exponent 2019). Wave action would also induce electrical and magnetic fields at the water surface on the order of 10 to 100 μ V/m and 1 to 10 mG (0.1 to 1 μ T), respectively, depending on wave height, period, and other factors. Although these effects dissipate with depth, wave action would likely produce detectable EMF effects up to 185 ft (56 m) below the surface (Slater et al. 2010). Petereit et al. (2019) found that tide-induced magnetic fields in the Gulf of Maine varied by approximately 0.68 nanoteslas (nT) between seasons, which was the largest seasonal difference found among the areas studied in this report.

Submarine transmission or communication cables can also contribute to EMF levels in an area. Electrical telecommunications cables are likely to induce a weak EMF in the immediate area along the cable path. Gill et al. (2005) observed electrical fields on the order of 1 to 6.3 μ V/m within 3.3 ft (1 m) of a typical cable of this type. The heat effects of communication cables on surrounding sediments are likely to be negligible given the limited transmission power levels involved. Currently there are two submarine cables which intersect partially with the Action Area (Northeast Regional Ocean Council 2023), installed between 1998 and 2005.

3.2.1.6 Artificial Light

Vessel traffic and navigational safety lights on buoys are the only artificial lighting sources in the open-water portion of the Action Area. Land-based artificial light sources become more predominant approaching the Maine, New Hampshire, and Massachusetts shorelines.

3.2.1.7 Vessel Traffic

In 2021, state and federally licensed commercial fishers 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. Recreational vessel traffic includes private motorboats, fishing boats, and sailboats. Most vessel traffic, excluding recreational vessels, tends to travel within established vessel traffic routes. There are four principal ports within the Action Area: Searsport, Maine; Portland, Maine; Portsmouth, New Hampshire; and Boston, Massachusetts (USACE 2023).

The Research Lease Area is located outside of existing designated routing measures; the western edge is located approximately 2.5 nautical miles (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-nautical mile (9.3-km) buffer zone of a TSS entry and exit area (as depicted in **Figure 3-3**) 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 square kilometers) or 14 percent of the Research Lease Area are located within the buffer zones of the Eastern Approach TSS. The USCG has proposed the addition of six shipping safety fairways within the Gulf of Maine due to planned or potential offshore development, changes in fishery management and species distribution, and port expansion in order to preserve the unobstructed transit of densely traveled routes and port approaches by mariners (USCG 2023).

In 2023, USCG completed the Approaches to Maine, New Hampshire, and Massachusetts Port Access Route Study (MNMPARS), 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). AIS vessel transit¹ counts in 2022 are presented in **Figure 3-3**; AIS and VMS data from 2019 through 2021 are shown in **Table 3-4**. These data provide a broad overview of the amount and type of vessels present in the MNMPARS study area (i.e., the Gulf of Maine), including general vessel traffic volume, patterns, and commonly trafficked routes for the Gulf of Maine. The number of vessel transits and unique vessel counts intersecting with the State of Maine's requested lease area is presented in **Table 3-5** based on AIS and VMS data from 2019 through 2021. AIS and VMS data sources can capture the presence of unique fishing vessels; however, not all vessels are required to use AIS transceivers, therefore if there was a discrepancy between the AIS and VMS data, the higher vessel quantity is shown in **Tables 3-4** and **3-5** (USCG 2023).

¹ A vessel transit is considered a single one-way vessel passing.

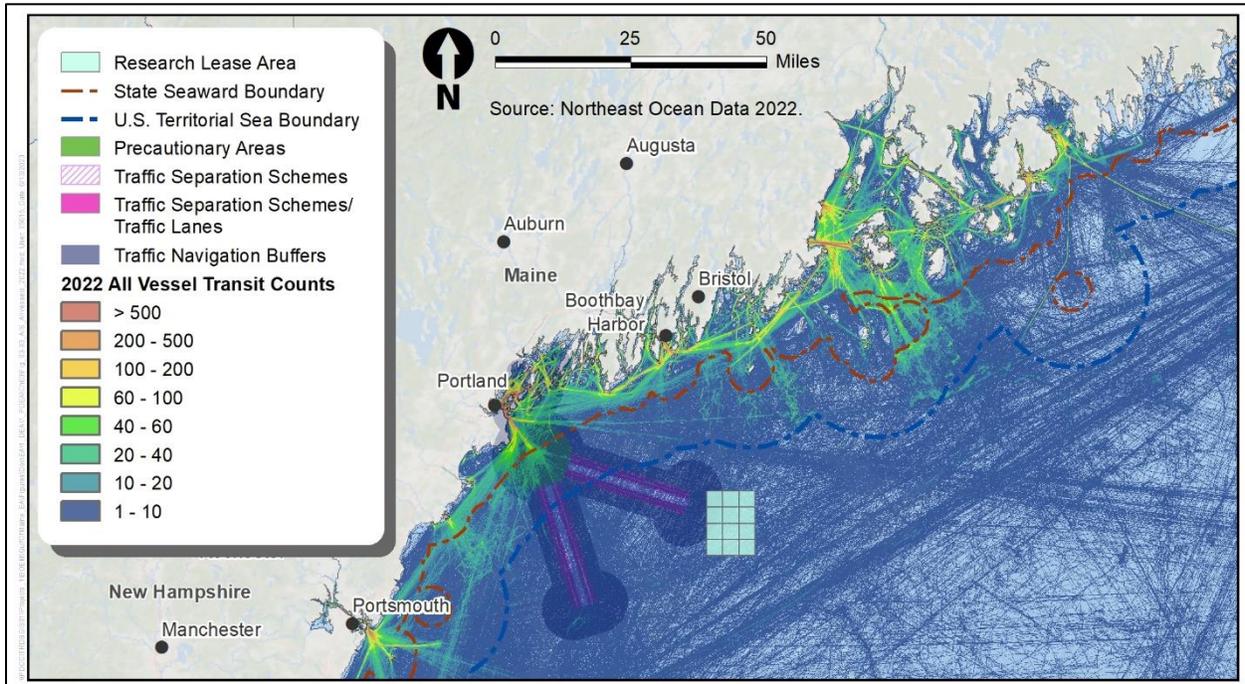


Figure 3-3. Automatic Identification System vessel transit counts for 2022 relative to the Research Lease Area

Table 3-4. Vessel transit and unique vessel counts by type for the Gulf of Maine (2019–2021)

Vessel Type	Vessel Transit 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

Table 3-5. Vessel transit and unique vessel counts by type intersecting the State of Maine’s requested lease area¹ (2019–2021)

Vessel Type	Vessel Transit 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 ²	47 ²	58 ²	22	24 ²	15 ²	20 ²
Tanker	29	25	27	27	15	17	17	16
Cargo	22	27	13	21	10	9	5	8
Not available	24	6	23	18	19	4	19	14
Passenger	40	0	2	14	25	0	2	9
Tug/Tow	8	6	6	7	5	3	2	3
Other	4	7	4	5	2	6	3	4
Military	0	0	1	0.3	0	0	1	0.3
Total	259	200	191	217	156	127	129	137

Source: USCG 2023.

¹ The State of Maine’s requested lease area is a 9,700-acre area within the Research Lease Area and is depicted in **Figure 3-2**.

² VMS data used. All other data from AIS.

Overall, the data indicate that the Gulf of Maine is heavily trafficked, with an average of 39,200 yearly transits recorded during the MNMPARS study period (2019 through 2021). The majority of vessel transits were conducted by fishing and recreational vessels, though these vessel categories are likely underrepresented in the data. Given its smaller area (i.e., 9,700 acres), fewer vessels intersect with the State of Maine’s requested lease area (**Table 3-5**). Pleasure craft/sailing traffic, fishing vessels, and tankers were the most common vessel types transiting through the requested lease area, with an average of 217 vessel transits per year, including 67 pleasure craft/sailing transits, 58 fishing transits, and 27 tanker transits per year.

An AIS transponder is only required on commercial vessels with a length of 65 feet (19.8 meters) or longer. Although some recreational and commercial fishing vessels smaller than 35 feet (10.7 meters) in length may choose to have a transponder, AIS is not mandatory on these vessels. VMS is also not mandatory on vessels. Therefore, these categories of vessels are underreported within the data presented above. When considering this limitation, the analysis of baseline vessel traffic for the Action Area as presented in this BA is likely an underestimate of actual ongoing vessel traffic.

3.2.1.8 Commercial and Recreational Fishing

Multiple commercial and recreational fishing grounds and banks are located within the Gulf of Maine. Fisheries within the Action Area are managed at both the Federal and regional level. At the Federal level, there are two councils designated by the Magnuson Fishery Conservation and Management Act of 1976 (later renamed the Magnuson-Stevens Fishery Conservation and Management Act): New England Fishery Management Council (NEFMC) for Connecticut, Massachusetts, Maine, New Hampshire, and Rhode Island. The commercial and recreational fishing within the Action Area is located entirely within the jurisdiction of the NEFMC. At the regional level, the 15 Atlantic states form the Atlantic States Marine Fisheries Commission. Species managed at the Federal level include sea scallop, Atlantic salmon, Atlantic herring by the NEFMC and Atlantic bluefish by the Mid-Atlantic Fishery Management Council (MAFMC); both councils jointly manage monkfish and spiny dogfish. Species managed at the regional

level include American lobster, black drum, red drum, tautog, and weakfish. Black sea bass, spiny dogfish, scup, and summer flounder are managed at both the Federal and regional level.

NMFS maintains landings data for commercial and recreational fisheries based on year, state, and species. Commercial fisheries that utilize the waters in the potential 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% of the total fishing revenue from Maine, New Hampshire, and Massachusetts waters, and 77.8% of revenue when considering Maine alone based on 2021 landings data (NMFS 2021a). Additional fisheries include menhadens, haddock, seaweed/rockweed, shortfin squid, and others.

There are multiple recreational fishing areas located within the Action Area, many of which are along the shoreline (Maine Department of Marine Resources 2023b). There are also numerous charter and head boats available in Maine which target a variety of species including striped bass, bluefin tuna, mackerel, sharks, bluefish, and others (Maine Department of Marine Resources 2023c). 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.

3.2.1.9 Climate Change

NMFS and the United States Fish and Wildlife Service (USFWS) list long-term climate changes as a threat for almost all marine species (Hayes et al. 2020, 2022; NMFS 2022a, 2023a; USFWS 2023a,b,c,d). Climate change is known to increase temperatures, alter 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. These effects can alter habitat, modify species' use of existing habitats, affect migration and movement patterns, and affect an organisms' physiological condition (Love et al. 2013; USEPA 2022; Gulland et al. 2022; National Aeronautics and Space Administration [NASA] 2023).

An increase in ocean acidity has numerous effects on ecosystems, fundamentally resulting in a reduction in available calcium carbonate that many marine organisms use to build shells (Doney et al. 2016). This could alter the distribution and abundance of marine mammal and sea turtle prey items and result in feeding shifts within food webs (Love et al. 2013; USEPA 2022; NASA 2023). For example, between 1982 and 2018, the average center of biomass for 140 marine fish and invertebrate species along U.S. coasts shifted approximately 20 mi (32 km) north (USEPA 2022). These species also migrated an average of 21 ft (6.4 m) deeper (USEPA 2022). This effect is especially profound off the northeast U.S., where American lobster, red hake, and black sea bass have shifted, on average, 113 mi (182 km) north since 1973 (USEPA 2022).

Climate change could affect the incidence or prevalence of infection and the frequency, severity, and magnitude of epizootics (Burge et al. 2014). Of the 72 established unusual mortality events identified for marine mammals between 1991 and 2022 in U.S. waters, 14 percent are attributed to infectious disease, though this has not been directly correlated with climate change (NMFS 2023a). However, infectious disease outbreaks are predicted to increase as a result of climate change (Burek et al. 2008).

Over time, climate change and coastal development will alter existing habitats, rendering some areas unsuitable for certain species and more suitable for others. For example, shifts in North Atlantic right whale (NARW) distribution patterns are likely in response to changes in prey densities, driven in part by climate change (Reygondeau and Beaugrand 2011; Meyer-Gutbrod et al. 2015, 2021; O'Brien et al. 2022). These long-term, high-consequence impacts could include increased energetic costs associated with altered migration routes; reduction of suitable breeding habitat, foraging habitat, or both; and reduced individual fitness.

Available data also suggest changing ocean temperatures and sea level rise may lead to changes in the sex ratio of sea turtle populations (e.g., green sea turtle [*Chelonia mydas*] population feminization predicted under Intergovernmental Panel on Climate Change scenarios by 2120; 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). In addition to affecting nesting activity, increased sea surface temperatures could have physiological effects on sea turtles during migration (Marn et al. 2017). Higher temperatures in migratory corridors would be especially risky for metabolic rates of female sea turtles post-nesting, as they do not generally forage during breeding periods, and their body condition would not be expected to be optimal to withstand unexpected changes in water temperature in their migratory habitat (Hays et al. 2014).

Finfish and invertebrate migration patterns can be influenced by warmer waters, as can the frequency and magnitude of disease (Hare et al. 2016). Regional water temperatures that increasingly exceed the thermal stress threshold may affect recovery of the American lobster fishery off the U.S. East Coast (Rheuban et al. 2017). Ocean acidification driven by climate change is contributing to reduced growth, and, in some cases, decline of invertebrate species with calcareous shells. Increased freshwater input into nearshore estuarine habitats can result in water quality changes and subsequent effects on invertebrate species (Hare et al. 2016). Based on a recent study, marine, estuarine, and riverine habitat types were found to be moderately to highly vulnerable to stressors resulting from climate change (Farr et al. 2021). In general, rocky and mud bottom, intertidal, kelp, coral, and sponge habitats and special areas of conservation were considered the most vulnerable habitats to climate change in marine ecosystems (Farr et al. 2021). Similarly, estuarine habitats considered most vulnerable to climate change include intertidal mud and rocky bottom, shellfish, kelp, submerged aquatic vegetation, and native wetland habitats (Farr et al. 2021). Riverine habitats found to be most vulnerable to climate change include native wetland, sandy bottom, water column, and submerged aquatic vegetation habitats (Farr et al. 2021). As invertebrate habitat, finfish habitat, and Essential Fish Habitat (EFH) may overlap with these habitat types, marine life and habitats could experience dramatic changes and decline over time as impacts from climate change continue (Farr et al. 2021).

The Gulf of Maine Research Institute (GMRI) reported an average sea surface temperature of 53.66°F (12°C) in the Gulf of Maine in 2022, which was the second hottest year on record and over 3.72°F above the long-term average from 1982 through 2011 (GMRI 2023). The hottest year on record was 54.14°F (12.3°C) in 2021, which was more than 4°F (1.5°C) above normal (GMRI, 2023). Long-term data show that the water temperatures in the Gulf of Maine have been increasing over the last decade at a rate faster than 97% of the world's oceans (Pershing et al., 2015; Pershing et al., 2021; Balch et al., 2022; Seidov and Parsons, 2021; GMRI 2023). The temperature changes have a cascading effect on all trophic levels. Changes in these trophic systems will likely have long term consequences on marine species that may not be recoverable (Pershing et al., 2015; Pershing et al., 2021). The extent of these effects is unknown; however, ESA-listed populations already stressed by other factors likely will be the most affected by the repercussions of climate change, particularly in the Gulf of Maine. The current effects from climate change could result in population-level effects that compromise the viability of some species.

3.3 Avoidance, Minimization, Monitoring, and Reporting Measures

This section outlines the proposed mitigation, monitoring, and reporting conditions intended to minimize or avoid potential effects on ESA-listed species. The measures considered part of the Proposed Action are those measures proposed by BOEM. Those measures, to the extent they are known, are described below.

BOEM will propose implementing the following conditions related to protected species and habitat. These conditions have been considered as part of the Proposed Action and apply to site assessment activities and site characterization activities. Additionally, the Lessee must also follow any applicable

mitigation requirements included with their MMPA take authorization, if such authorization is pursued or deemed necessary.

As used herein, the term “protected species” means species of fish, wildlife, or plant that have been determined to be endangered or threatened under Section 4 of the ESA. ESA-listed species are provided in 50 C.F.R. 17.11-12. The term also includes marine mammals protected under the MMPA. Marine debris is defined as any object or fragment of wood, metal, glass, rubber, plastic, cloth, paper, or any other man-made item or material that is lost or discarded in the marine environment.

3.3.1 Marine Debris Awareness and Elimination

The Lessee must ensure that vessel operators, employees, and contractors engaged in offshore activities as part of the Proposed Action complete marine trash and debris awareness training annually. The training consists of two parts: (1) viewing a marine trash and debris training video or slide show (described below); and (2) receiving an explanation from management personnel that emphasizes their commitment to the requirements. The marine trash and debris training videos, training slide packs, and other marine debris related educational material may be obtained at <https://www.bsee.gov/debris> or by contacting BSEE at marinedebris@bsee.gov. The training videos, slides, and related material may be downloaded directly from the website. Operators engaged in marine survey activities must continue to develop and use a marine trash and debris awareness training and certification process that reasonably assures that their employees and contractors are trained. The training process must include the following elements:

- Viewing of either a video or slide show by the personnel specified above;
- An explanation from management personnel that emphasizes their commitment to the requirements;
- Attendance measures (initial and annual); and
- Recordkeeping and the availability of records for inspection by the Department of the Interior (DOI).

By January 31 of each year, the Lessee must submit to DOI an annual report signed by the Lessee that describes its marine trash and debris awareness training process and certifies that the training process has been followed for the previous calendar year. The Lessee must send the reports via email to email to renewable_reporting@boem.gov and BSEE (via Technical Information Management System (TIMS) Web Portal and protectedspecies@bsee.gov).

Materials, equipment, tools, containers, and other items used in OCS activities, which are of such shape or configuration that make them likely to snag or damage fishing devices or be lost or discarded overboard, must be clearly marked with the vessel or facility identification number, and properly secured to prevent loss overboard. All markings must clearly identify the owner and must be durable enough to resist the effects of the environmental conditions to which they may be exposed.

The Lessee must recover marine trash and debris that is lost or discarded in the marine environment while performing OCS activities when such incident is likely to (1) cause undue harm or damage to natural resources, including their physical, atmospheric, and biological components, with particular attention to marine trash or debris that could entangle or be ingested by marine protected species; or (2) significantly interfere with OCS uses (e.g., the marine trash or debris that is likely to snag or damage fishing equipment, or present a hazard to navigation). The Lessee must notify DOI within 48 hours of the incident (using the email address listed on DOI’s most recent incident reporting guidance) if recovery activities are (a) not possible because conditions are unsafe; or (b) not practicable and warranted because the marine trash and debris released is not likely to result in any of the conditions listed in (1) or (2) above. Notwithstanding this notification, DOI may still order the Lessee to recover the lost or discarded marine trash and debris if DOI finds the reasons provided by the Lessee in the notification unpersuasive. If the marine trash and debris is located within the boundaries of a potential archaeological

resource/avoidance area, or a sensitive ecological/benthic resource area, the Lessee must contact DOI for concurrence before conducting any recovery efforts.

Recovery of the marine trash and debris should be completed as soon as practicable, but no later than 30 calendar days from the date on which the incident occurred. If the Lessee is not able to recover the marine trash or debris within 48 hours of the incident, the Lessee must submit a plan to DOI explaining the activities planned to recover the marine trash or debris (Recovery Plan). The Lessee must submit the Recovery Plan no later than 10 calendar days from the date on which the incident occurred. Unless DOI objects within 48 hours of the filing of the Recovery Plan, the Lessee can proceed with the activities described in the Recovery Plan. The Lessee must request and obtain a time extension if recovery activities cannot be completed within 30 calendar days from the date on which the incident occurred. The Lessee must enact steps to prevent similar incidents and must submit a description of these actions to BOEM and BSEE within 30 calendar days from the date on which the incident occurred.

The Lessee must report to DOI (OSWIncidentReporting@bsee.gov) all lost or discarded marine trash and debris. This report must be made monthly and submitted no later than the fifth day of the following month. The Lessee is not required to submit a report for those months in which no marine trash and debris was lost or discarded. The report must include the following:

- Project identification and contact information for the Lessee and for any operators or contractors involved.
- The date and time of the incident.
- The lease number, OCS area and block, and coordinates of the object's location (latitude and longitude in decimal degrees).
- A detailed description of the dropped object, including dimensions (approximate length, width, height, and weight) and composition (e.g., plastic, aluminum, steel, wood, paper, hazardous substances, or defined pollutants).
- Pictures, data imagery, data streams, and/or a schematic/illustration of the object, if available.
- An indication of whether the lost or discarded item could be detected as a magnetic anomaly of greater than 50 nT, a seafloor target of greater than 1.6 ft (0.5 m), or a sub-bottom anomaly of greater than 1.6 ft (0.5 m) when operating a magnetometer or gradiometer, side scan sonar, or sub-bottom profiler in accordance with DOI's most recent, applicable guidance.
- An explanation of how the object was lost.
- A description of immediate recovery efforts and results, including photos.
- In addition to the foregoing, the Lessee must submit a report within 48 hours of the incident (48-hour Report) if the marine trash or debris could (1) cause undue harm or damage to natural resources, including their physical, atmospheric, and biological components, with particular attention to marine trash or debris that could entangle or be ingested by marine protected species; or (2) significantly interfere with OCS uses (e.g., the marine trash or debris is likely to snag or damage fishing equipment or presents a hazard to navigation). The information in the 48-hour Report must be the same as that listed for the monthly report, but only for the incident that triggered the 48-hour Report. The Lessee must report to DOI (using the email address listed on DOI's most recent incident reporting guidance) if the object is recovered and, as applicable, describe any substantial variance from the activities described in the Recovery Plan that were required during the recovery efforts. The Lessee must include and address information on unrecovered marine trash and debris in the description of the site clearance activities provided in the decommissioning application required under 30 C.F.R. § 585.906.

3.3.2 Minimize Vessel Interactions with Listed Species

Ensure all vessels associated with any project activities (transiting or actively surveying) comply with the vessel strike avoidance measures specified below. The only exception is when the safety of the vessel or crew necessitates deviation from these requirements. If any such incidents occur, they must be reported as outlined in **Section 3.3.6**.

3.3.2.1 Vessel Crew and Trained Lookout Training

The Lessee must provide Project-specific training to all vessel crew members and trained lookouts on the detection of sea turtles and marine mammals, vessel strike avoidance, reporting protocols, and the associated regulations for avoiding vessel collisions with protected species. Trained lookouts are used when professional, third-party PSOs are not required. Third-party PSO requirements are outlined in **Section 3.3.5**. Trained lookouts must receive additional training in protected species identification, vessel strike minimization procedures, how and when to communicate with the vessel captain, and reporting requirements. Reference materials for identifying sea turtles and marine mammals must be available aboard all Project vessels. The expectation and process for reporting of protected species sighted during surveys must be clearly communicated and posted in highly visible locations aboard all project vessels, so that there is an expectation for reporting to the designated vessel contact (such as the lookout or the vessel captain), as well as a communication channel and process for crew members to do so.

Confirmation of the training and understanding of the requirements must be documented on a training course log sheet, and the Lessee must provide the log sheets to DOI upon request. The Lessee must communicate to all crew members its expectation for them to report sightings of sea turtles and marine mammals to the designated vessel contacts. The Lessee must communicate the process for reporting sea turtles and marine mammals (including live, entangled, and dead individuals) to the designated vessel contact and all crew members. The Lessee must post the reporting instructions, including communication channels, in highly visible locations aboard all Project vessels.

3.3.2.2 Vessel Observation Requirements

1. Vessel captain and crew must maintain a vigilant watch for all protected species and reduce speed, stop their vessel, or alter course, as appropriate and regardless of vessel size, to avoid striking any listed species. The presence of a single individual at the surface may indicate the presence of submerged animals in the vicinity; therefore, precautionary measures should always be exercised. If pinnipeds or small delphinids of the following genera: *Delphinus*, *Lagenorhynchus*, *Stenella*, and *Tursiops* are visually detected approaching the vessel (i.e., to bow ride) or towed equipment, vessel speed reduction, course alteration, and shutdown are not required.
2. Anytime a survey vessel is underway (transiting or surveying), a PSO must monitor for protected species, and the vessel must maintain a minimum separation distance of 1,640 ft (500 m) or greater from any sighted ESA-listed species, or other unidentified large marine mammal visible at the surface, to ensure detection of that animal in time to take necessary measures to avoid striking the animal. If a survey vessel does not require a PSO for the type of survey equipment used, crew may be used as a Trained Lookout to meet this requirement. For monitoring around ASVs controlled from a manned vessel, regardless of the equipment it may be operating, a dual thermal/HD camera must be installed on the mother vessel facing forward and angled in a direction so as to provide a field of view ahead of the vessel and around the ASV. A dedicated operator must be able to monitor the real-time output of the camera on hand-held computer tablets. Images from the cameras must be able to be captured and reviewed to assist in verifying species identification. A monitor must also be installed in the bridge displaying the real-time images from the thermal/HD camera installed on the front of the ASV itself, providing a further forward view of the craft.

- a. Survey plans (see Section 3.3.6.1 for further details) must include identification of the PDCs for vessel strike avoidance measures, including procedures for equipment shut down and retrieval, communication between PSOs/Trained Lookouts, equipment operators, and the captain, and other measures necessary to avoid vessel strikes while maintaining vessel and crew safety. If any circumstances are anticipated that may preclude the implementation of this PDC, they must be clearly identified in the survey plan and alternative procedures outlined in the plan to ensure minimum distances are maintained and vessel strikes can be avoided.
- b. All vessel crew members must be briefed in the identification of protected species that may occur in the survey area and in regulations and best practices for avoiding vessel collisions. Reference materials must be available aboard all project vessels for identification of listed species. The expectation and process for reporting of protected species sighted during surveys must be clearly communicated and posted in highly visible locations aboard all project vessels, so that there is an expectation for reporting to the designated vessel contact (such as the lookout or the vessel captain), as well as a communication channel and process for crew members to do so.
- c. A minimum separation distance of 500 m from all ESA-listed whales (including unidentified large whales) must be maintained around all surface vessels at all times.
- d. If a large whale is identified within 500 m of the forward path of any vessel, the vessel operator must steer a course away from the whale at 10 knots (18.5 km/hr) or less until the 500 m minimum separation distance has been established. Vessels may also shift to idle if feasible.
- e. If a large whale is sighted within 200 m of the forward path of a vessel, the vessel operator must reduce speed and shift the engine to neutral. Engines must not be engaged until the whale has moved outside of the vessel's path and beyond 500 m. If stationary, the vessel must not engage engines until the large whale has moved beyond 500 m.
- f. If a sea turtle or manta ray is sighted at any distance within the operating vessel's forward path, the vessel operator must slow down to 4 knots and steer away (unless unsafe to do so). The vessel may resume normal vessel operations once the vessel has passed the individual.
- g. Vessels must avoid transiting through areas of visible jellyfish aggregations or floating vegetation (e.g., sargassum lines or mats) that are easily sighted and exceed 50 meters in length or width. In the event that operational safety prevents avoidance of such areas, vessels must slow to 4 knots while transiting through such areas.
- h. Vessels operating in water depths with less than four feet of clearance between the vessel and the bottom should maintain speeds no greater than 4 kts to minimize risk of vessel strikes on sturgeon and sawfish.
- i. Any observations of a marine mammal or ESA-listed species by crew members aboard any vessel associated with the survey must be relayed to the PSO on duty and/or captain of the vessel.

To monitor the minimum separation distance, a PSO (or Trained Lookout if PSOs are not required) must be posted during all times a vessel is underway (transiting or surveying) to monitor for listed species within a 180-degree direction of the forward path of the vessel (90 degrees port to 90 degrees starboard).

- a. Visual observers monitoring the minimum separation distance can be either PSOs or Trained Lookouts (if PSOs are not required). If the Trained Lookout is a vessel crew member, this must be their designated role and primary responsibility on shift. Any crew designated as Trained Lookouts must receive training on protected species identification, vessel strike minimization procedures, how and when to communicate with the vessel captain, and reporting requirements. All observations must be recorded per reporting requirements.
- b. Regardless of monitoring duties, all crew members responsible for navigation duties must receive

site-specific training on ESA-listed species sighting/reporting and vessel strike avoidance measures.

- c. Vessels underway must not divert their course to approach any ESA-listed species and marine mammals.

Regardless of vessel size, vessel operators must reduce vessel speed to 10 knots (18.5 mph) or less while operating in any Seasonal Management Area (SMA) and Dynamic Management Area (DMA) or Slow Zone triggered by visual detections of North Atlantic right whales. An exception to this requirement is for vessels operating in areas within a portion of a visually designated DMA or Slow Zone where it is not reasonable to expect the presence of North Atlantic right whales (e.g., Long Island Sound, shallow harbors), unless a sighting of a North Atlantic right whale in that area triggered the DMA/Slow Zone.

BOEM encourages increased vigilance through the required best management practices to minimize vessel interactions with protected species, by reducing speeds to 10 knots or less when operating within an acoustically triggered Slow Zone, and when feasible, avoid operating in or transiting through Slow Zones.

Ensure all vessel operators check for information regarding mandatory or voluntary ship strike avoidance (SMAs and DMAs (or Slow Zones) and daily information regarding North Atlantic right whale sighting locations. These media may include, but are not limited to: NOAA weather radio, U.S. Coast Guard NAVTEX and channel 16 broadcasts, Notices to Mariners, the Whale Alert app, or WhaleMap website.

- a. North Atlantic right whale Sighting Advisory System info can be accessed at: <https://apps-nefsc.fisheries.noaa.gov/psb/surveys/MapperiframeWithText.html>.
- b. Information about active SMAs, DMAs, and Slow Zones can be accessed at: <https://www.fisheries.noaa.gov/national/endangered-species-conservation/reducing-vessel-strikes-north-atlantic-right-whales>.

All vessels transiting to and from the Action Area must have a trained lookout for North Atlantic right whales (NARWs) on duty at all times, during which the trained lookout must monitor a vessel strike avoidance zone around the vessel. The trained lookout must maintain a vigilant watch at all times a vessel is underway and, when technically feasible, monitor the 500-meter Vessel Strike Avoidance Zone for ESA-listed species to maintain minimum separation distances.

Alternative monitoring technology (e.g., night vision, thermal cameras) must be available to maintain a vigilant watch at night and in any other low-visibility conditions. Vessel personnel must be provided with an Atlantic reference guide to help identify marine mammals and sea turtles that may be encountered. Vessel personnel must also be provided material regarding NARW Seasonal Management Areas (SMAs), Dynamic Management Areas (DMAs), visually triggered Slow Zones, sightings information, and reporting.

All observations must be recorded per reporting requirements. Outside of active watch duty, members of the monitoring team must check NMFS' NARW sightings for the presence of NARWs in the Action Area. The trained lookout must check the Sea Turtle Sighting Hotline before each trip and report any detections of sea turtles in the vicinity of the planned transit to all vessel operators or captains and lookouts on duty that day.

For all vessels operating north of the Virginia/North Carolina border, the Lessee must have a trained lookout posted between June 1 and November 30 on all vessel transits during all phases of the Project to observe for sea turtles. If a vessel is carrying a trained lookout for the purposes of maintaining watch for NARWs, an additional trained lookout for sea turtles is not required, provided that the trained lookout maintains watch for marine mammals and sea turtles. If the trained lookout is a vessel crew member, the

lookout obligations as noted above must be that person's designated role and primary responsibility while the vessel is transiting.

3.3.2.3 Vessel Speed Requirements

Vessels of all sizes must operate at 11.5 mph (18.5 kph or 10 kn) or less between November 1 and April 30 and while operating port to port and operating in the lease area, or in the transit area to and from ports in Maine, New Hampshire, and Massachusetts. Regardless of vessel size, vessel operators must reduce vessel speed to 11.5 mph (18.5 kph or 10 kn) or less while operating in any SMA or DMA or visually detected Slow Zones. An exception to this requirement is for vessels operating in areas within a portion of a visually designated DMA or Slow Zone where it is not reasonable to expect the presence of North Atlantic right whales (e.g., Long Island Sound, shallow harbors), unless a sighting of a North Atlantic right whale in that area triggered the DMA/Slow Zone. This requirement also does not apply when necessary for the safety of the vessel or crew. Any such events must be reported.

BOEM encourages increased vigilance through the required best management practices to minimize vessel interactions with protected species, by reducing speeds to 10 knots or less when operating within an acoustically triggered Slow Zone, and when feasible, avoid operating in or transiting through Slow Zones. All vessel operators must check for information regarding mandatory or voluntary ship strike avoidance and daily information regarding NARW sighting locations. These media may include, but are not limited to, the following: NOAA weather radio, Coast Guard NAVTEX and Channel 16 broadcasts, Notices to Mariners, Whale Alert app, NARW Sighting Advisory System, WhaleMap website, or information on active SMAs and Slow Zones.

The Lessee may only request a waiver from any visually triggered Slow Zone or DMA vessel speed reduction requirements during operations and maintenance by submitting a vessel strike risk reduction plan that details revised measures and an analysis demonstrating that the measure(s) will provide a level of risk reduction at least equivalent to the vessel speed reduction measure(s) proposed for replacement. The plan included with the request must be provided to NMFS Greater Atlantic Regional Fisheries Office, Protected Resources Division and BOEM at least 90 days prior to the date scheduled for the activities for which the waiver is requested. The plan must not be implemented unless NMFS and BOEM reach consensus on the appropriateness of the plan.

3.3.2.4 Vessel Strike Avoidance of ESA-listed species

A minimum separation distance of 500 m from all ESA-listed whales (including unidentified large whales) must be maintained around all surface vessels at all times.

If a large whale is identified within 500 m of the forward path of any vessel, the vessel operator must steer a course away from the whale at 10 knots (18.5 km/hr) or less until the 500 m minimum separation distance has been established. Vessels may also shift to idle if feasible.

If a large whale is sighted within 200 m of the forward path of a vessel, the vessel operator must reduce speed and shift the engine to neutral. Engines must not be engaged until the whale has moved outside of the vessel's path and beyond 500 m. If stationary, the vessel must not engage engines until the large whale has moved beyond 500 m.

If a sea turtle is sighted at any distance within the operating vessel's forward path, the vessel operator must slow down to 4 knots and steer away (unless unsafe to do so). The vessel may resume normal vessel operations once the vessel has passed the individual.

Vessels must avoid transiting through areas of visible jellyfish aggregations or floating vegetation (e.g., sargassum lines or mats) that are easily sighted and exceed 50 m in length or width. In the event that

operational safety prevents avoidance of such areas, vessels must slow to 4 knots while transiting through such areas.

Vessels operating in water depths with less than four feet of clearance between the vessel and the bottom should maintain speeds no greater than 4 kts to minimize risk of vessel strikes on sturgeon.

Vessels underway must not divert their course to approach any protected species.

3.3.3 Minimize Interactions with Listed Species during Geophysical Survey Operations

To avoid injury of and minimize any potential disturbance to protected species, implement the following measures for all vessels using boomer, sparker, bubble gun, and chirp sub-bottom profiler categories of equipment. Shutdown, pre-start clearance, and ramp-up procedures are not required during HRG survey operations using only other sources (e.g., ultra-short baselines, fathometers, parametric shallow penetration sub-bottom profilers, hull-mounted non-parametric SBP, side-scan sonars, pingers, acoustic releases, echosounders, and instruments attached to submersible vehicles (HOV/AUV/ROVs).

1. For situational awareness of marine mammals and ESA-listed species that may be in the survey area, during times third-party protected species observers (PSOs) are on duty, they must monitor to the farthest extent practicable, with a primary focus being 200 m around geophysical survey vessels (i.e., the Clearance Zone). At all times PSOs are on duty, any observed species must be recorded (see reporting requirements below).
2. Any observations of a marine mammal or ESA-listed species by crew members aboard any vessel associated with the survey must be relayed to the PSO on duty.
3. For autonomous surface vessels (ASV) that require remote PSO monitoring from the mother vessel², a dual thermal/HD camera must be installed on the mother vessel facing forward and angled in a direction to provide a field of view ahead of the vessel and around the ASV. PSOs must be able to monitor the real-time output of the camera on hand-held computer tablets. Images from the cameras must be able to be captured and reviewed to assist in verifying species identification. A monitor must also be installed in the bridge displaying the real-time images from the thermal/HD camera installed on the front of the ASV itself, providing a further forward view of the craft. In addition, night-vision goggles with thermal clip-ons and a handheld spotlight must be provided and used such that PSOs can focus observations in any direction around the mother vessel and/or the ASV.
4. To minimize exposure of ESA-listed species of marine mammal to noise that could be disturbing, a 200 m Shutdown Zone for NARW and unidentified whales, and a 100 m Shutdown Zone for all other ESA-listed whales visible at the surface must be established around the sound source operating boomer, sparker, or bubble gun equipment. If the Shutdown Zone(s) cannot be adequately monitored for ESA-listed species presence (i.e., PSO discretion determines conditions, including night or other low visibility conditions, are such that listed species cannot be reliably sighted within the Shutdown Zone(s) with the available monitoring equipment, no equipment that requires PSO monitoring can be deployed until such time that the Shutdown Zone(s) can be effectively monitored.
5. The Shutdown Zone(s) must be monitored by third-party PSOs at all times when boomer, sparker, bubble gun, or Chirp sub-bottom profiler categories of equipment are being operated and all observed ESA-listed species must be recorded (see reporting requirements below).
6. If an ESA-listed whale is detected within or entering the respective Shutdown Zone, any boomer, sparker, or bubble gun categories of equipment that requires PSOs must be shut off until the

² Lessees must discuss ASV deployment with BOEM prior to contracting to understand what measures may be necessary for the ASV system under consideration.

minimum separation distance is re-established, and the clearance measures are carried out (200 m for North Atlantic right whales and 100 m for other ESA-listed whales).

7. A PSO must notify the survey crew that a shutdown of all active boomer, sparker, and bubble gun acoustic sources is immediately required. The vessel operator and crew must comply immediately with any call for a shutdown by the PSO. Any disagreement or discussion must occur only after shutdown.
8. For all protected species, Clearance Zones of 200 m for all ESA-listed species of marine mammal must be clear of all animals for 30 minutes before ramp-up or any deployed survey equipment is activated.
9. If any protected species is observed within the respective Clearance Zone during the 30-minute pre-clearance period, the relevant acoustic sources must not be initiated until the ESA listed whale (or unidentified whale) is confirmed by visual observation to have exited the relevant zone, or, until 30 minutes have elapsed with no further sighting of the animal.
10. A “ramp up” of the boomer, sparker, or bubble gun survey equipment must occur at the start or re-start of geophysical survey activities when technically feasible. A ramp up must begin with the power for the geophysical survey equipment ramped up half power for 5 minutes, and then to full power.
11. Following a shutdown for any reason, ramp up of the equipment may begin immediately only if: (a) the shutdown is less than 30 minutes, (b) visual monitoring of the Shutdown Zone(s) continued throughout the shutdown, (c) the animal(s) causing the shutdown was visually followed and confirmed by PSOs to be outside of the Shutdown Zone(s) and heading away from the vessel, and (d) the Shutdown Zone(s) remains clear of all ESA-listed species. If all the conditions above are not met, a 500 m distance must be monitored for all ESA-listed species for 30 minutes of pre-clearance observation before noise-producing equipment can be turned back on.
12. No geophysical surveys may be conducted at night or during low-visibility conditions unless PSOs are able to effectively monitor the full extent of the Clearance and Shutdown Zone(s).
13. An Alternative Monitoring Plan (AMP) must be included with the survey plan detailing the monitoring methodology that will be used during nighttime and low-visibility conditions. The AMP must demonstrate how it will support effective monitoring for the presence of whales and sea turtles in the Clearance and Shutdown Zone(s). The AMP must include information about the distances that whales can be effectively detected using the identified technology/equipment, and any limitations posed by sea state(s) or vessel equipment (e.g., deck lights) that may inhibit the field of view.
14. The AMP must include technologies that have the technical feasibility to detect all ESA-listed species in the Clearance and Shutdown Zone(s). Low-light equipment (i.e., night-vision goggles and/or infrared technology) must be available for use during low visibility (e.g., inclement weather, nighttime) monitoring.
15. PSOs must be trained and experienced with any AMP technology used. The AMP must describe how calibration will be performed, for example, by including observations of known objects at set distances and under various lighting conditions. This calibration should be performed during mobilization and periodically throughout the survey operation.
16. PSOs shall make nighttime observations from a platform with no visual barriers, due to the potential for the reflectivity from bridge windows or other structures to interfere with the use of the night vision optics.
17. To minimize risk to North Atlantic right whales, no surveys may occur in Cape Cod Bay from January 1–May 15 of any year (in an area beginning at 42°04'56.5" N-070°12'00.0" W; thence north

to 42°12'00.0" N-070°12'00.0" W; thence due west to charted mean high-water line; thence along charted mean high water within Cape Cod Bay back to beginning point).

18. Boomer, sparker, bubble gun, or Chirp sub-bottom profiler sound sources used within the Southeast Right Whale Critical Habitat Unit 2 during the calving and nursing season (December-March) shall not operate at frequencies between 7 kHz and 35 kHz at night or poor visibility (i.e., anytime AMP methods are required).
19. During good conditions (e.g., daylight hours; Beaufort scale 3 or less) when survey equipment is not operating, to the maximum extent practicable (accounting for recommended shift schedules and vessel activities), PSOs should conduct observations for listed species for comparison of sighting rates and behavior with and without use of active geophysical survey equipment. Any observed listed species must be recorded regardless of any mitigation actions required.

3.3.4 Minimize Vessel Interactions with Listed Species during use of a Moon Pool

During times of year when sea turtles are known to occur in the survey area and there is an intention to utilize a moon pool for the required activities, the following BMPs need to be followed:

1. Closure of the Hull Door:
 - a. Should the moon pool have a hull door that can be closed, then prior to and following closure, the moon pool must be monitored continuously by a dedicated crew observer with no other tasks to ensure that no individual protected species is present in the moon pool area. If visibility is not clear to the hull door from above (e.g., turbidity or low light), 30 minutes of monitoring is required prior to hull door closure.
 - b. If a protected species is observed in the moon pool prior to closure of the hull door, the hull door must not be closed, to the extent practicable. If the observed animal leaves the moon pool, the operator may commence closure. If the observed animal remains in the moon pool, contact BSEE prior to closure of the hull doors according to reporting requirements (see *below* under *Reporting of Observations of Protected Species within an Enclosed Moon Pool*).
2. Reporting of Observations of Protected Species within an Enclosed Moon Pool:
 - a. If a protected species is observed within an enclosed moon pool and does not demonstrate any signs of distress or injury or an inability to leave the moon pool of its own volition, measures described in this section must be followed (only in cases where they do not jeopardize human safety). Although this particular situation may not require immediate assistance and reporting, a protected species could potentially become disoriented with their surroundings and may not be able to leave the enclosed moon pool of their own volition. In order for operations requiring use of a moon pool to continue, the following reporting measures must be followed:

Within 24 hours of any observation, and daily after that for as long as an individual protected species remains within a moon pool (i.e., in cases where an ESA listed species has entered a moon pool but entrapment or injury has not been observed), The following information must be reported to BSEE (protectedspecies@bsee.gov):

- For an initial report, all information described above should be included.
- For subsequent daily reports:
 - Describe the animal's status to include external body condition (e.g., note any injuries or noticeable features), behaviors (e.g., floating at surface, chasing fish, diving, lethargic, etc.), and movement (e.g., has the animal left the moon pool and returned on multiple occasions?);
 - Description of current moon pool activities, if the animal is in the moon pool (e.g., drilling,

- preparation for demobilization, etc.);
- Description of planned activities in the immediate future related to vessel movement or deployment of equipment;
- Any additional photographs or video footage of the animal, if possible;
- Guidance received and followed from NMFS liaison or stranding hotline that was contacted for assistance;
- Whether activities in the moon pool were halted or changed upon observation of the animal; and
- Whether the animal remains in the pool at the time of the report, or if not, the time/date the animal was last observed.

BOEM does not advocate the lowering of crew members into the moon pool to free protected species and NMFS should be contacted if protected species are encountered in the moon pool.

3.3.5 PSO Requirements

When surveys or vessels require the use PSOs (as opposed to Trained Lookouts), the Lessee must use PSOs provided by a third party to observe Clearance and Shutdown Zones, and implement mitigation measures as outlined in the conditions in the previous and following subsections. Additionally:

1. All PSOs must have completed a training program with BOEM-approved PSO training materials. PSOs must also have received NMFS approval to act as a PSO for geophysical surveys. The Lessee must provide to BOEM upon request, documentation of NMFS approval as PSOs for geophysical activities in the Atlantic and copies of the most recent training certificates of individual PSOs' successful completion of a commercial PSO training course with an overall examination score of 80% or greater. Instructions and application requirements to become a NMFS- approved PSO can be found at: <https://www.fisheries.noaa.gov/national/endangered-species-conservation/protected-species-observers>.
2. For situations where Trained Lookouts are used when PSOs are not required, training must include protected species identification, vessel strike minimization procedures, how and when to communicate with the vessel captain, and reporting requirements
3. PSOs deployed for mitigation, monitoring, and reporting of geophysical survey activities must be employed by a third-party observer provider. While the vessel is underway, they must have no other tasks other than to conduct observational effort, record data, communicate with and instruct relevant vessel crew to the presence of listed species and implement required PDCs and BMPs. PSOs on duty must be clearly listed on daily data logs for each shift.
 - a. Non-third-party observers may be approved by NMFS on a case-by-case basis for limited, specific duties in support of approved, third-party PSOs.
4. A minimum of one PSO must be observing for listed species on each vessel at all times that noise-producing equipment is operating, or the survey vessel is actively transiting. The Lessee must include a PSO schedule showing that the number of PSOs used is sufficient to effectively monitor the affected area for the project (e.g., surveys) and record the required data. PSOs must not be on watch for more than 4 consecutive hours, with at least a 2-hour break after a 4-hour watch. PSOs must not work for more than 12 hours in any 24-hour period.
5. Visual monitoring must occur from the most appropriate vantage point on the associated operational platform that allows for maximum possible 360-degree field of view around the sound source and vessel. If 360-degree field of view is not possible from a single vantage point, multiple PSOs must be

on watch to ensure such coverage to ensure both geophysical survey and vessel strike avoidance requirements for ESA-listed species can be implemented.

6. The Lessee must ensure that suitable equipment is available to each PSO to adequately observe the full extent of the Clearance and Shutdown Zones prior to and during all geophysical survey activity respectively and meet all reporting requirements. The following equipment must be available.
 - a. Visual observations must be conducted using binoculars and the naked eye while free from distractions and in a consistent, systematic, and diligent manner.
 - b. Rangefinders (at least one per PSO, plus backups) or reticle binoculars (e.g., 7 x 50) of appropriate quality (at least one per PSO, plus backups) to estimate distances to listed species located in proximity to the Clearance and Shutdown Zone(s).
 - c. Digital cameras with a telephoto lens that is at least 300 mm or equivalent on a full-frame single lens reflex (SLR). The camera or lens should also have an image stabilization system. Used to record sightings and verify species identification when possible.
 - d. A laptop or tablet to collect and record data electronically.
 - e. Global Positioning Units (GPS) if data collection/reporting software does not have built-in positioning functionality.
 - f. PSO data must be collected in accordance with standard data reporting, software tools, and electronic data submission standards approved by BOEM and NMFS for the particular activity.
 - g. Any other tools deemed necessary to adequately perform PSO tasks.

PSOs must have no Project-related tasks other than to observe, collect and report data, and communicate with and instruct relevant vessel crew regarding the presence of protected species and mitigation requirements (including brief alerts regarding maritime hazards). PSOs must have completed a commercial PSO training program for the Atlantic with an overall examination score of 80% or greater. The Lessee must provide training certificates for individual PSOs to BOEM upon request. PSOs and PAM operators must be approved by NMFS before the start of a survey.

PSOs must be approved by NMFS prior to the start of a survey, and the Lessee must submit documentation of NMFS' approval upon request to BOEM (at renewable_reporting@boem.gov) and BSEE (via TIMS Web Portal and protectedspecies@bsee.gov). Application requirements to become a NMFS-approved PSO for geological and geophysical surveys can be obtained by sending an inquiry to nmfs.psoreview@noaa.gov.

Lead PSOs must have prior approval from NMFS as an unconditionally approved PSO.

- a. At least one lead PSO must be present on each HRG survey vessel.
- b. PSOs on transit vessels must be approved by NMFS but need not be authorized as a lead PSO.
- c. All PSOs on duty must be clearly listed and the lead PSO identified on daily data logs for each shift.
- d. A sufficient number of PSOs must be deployed to record data in real time and effectively monitor the required clearance, shutdown, or monitoring zone for the Project.
- e. Where applicable, the number of PSOs deployed must meet the NARW enhanced seasonal monitoring requirements.
- f. A PSO must not be on watch for more than 4 consecutive hours and must be granted a break of no fewer than 2 hours after a 4-hour watch.

- g. A PSO must not work for more than 12 hours in any 24-hour period unless an alternative schedule is authorized in writing by BOEM.
- h. The Lessee must ensure that suitable equipment is available to PSOs (including binoculars, range-finding equipment, a digital camera, and electronic data recording devices [e.g., a tablet]) to adequately monitor the extent of the clearance and shutdown zones, determine the distance to protected species during surveys, record sightings and verify species identification, and record data. PSO observations must be conducted while free from distractions and in a consistent, systematic, and diligent manner.

3.3.6 Reporting Requirements

To ensure compliance and evaluate effectiveness of mitigation measures, regular reporting of survey activities and information on listed species will be required as follows. Only vessel surveys which require third-party PSOs will be required to meet reporting requirements under Sections **3.3.6.1** through **3.3.6.4**. Reporting requirements listed under **Sections 3.3.6.5** and **3.3.6.6** must be completed if applicable regardless of survey type or type of observer.

3.3.6.1 Survey Reporting

Prior to conducting each physical, biological, or cultural resources survey in support of the submission of a plan, the Lessee must submit to the Lessor a survey plan. Each distinct survey effort (e.g., mobilization) must be addressed by a survey plan, although a single survey plan may cover more than one survey effort and may cover multiple types of activities (e.g., geotechnical and geophysical surveys on lease and along cable routes).

Each survey plan must include details of activities to be conducted and timelines of each survey effort necessary to support the submission of a plan (i.e., necessary to satisfy the information requirements in the applicable regulations, including but not limited to 30 CFR 585.606, 610,611,621,626,627, et al.). The Lessor will not accept survey plans that do not provide sufficient detail for review, including but not limited to specific description and illustration of the geographic areas to be surveyed, specific discussion of the survey methods and equipment to be employed, and a schedule of survey activities.

The Lessee must demonstrate compliance include any waiver requests in its initial survey plan and the Lessee's intentions to coordinate with the U.S. Coast Guard (USCG) to prepare a Notice to Mariners for the specific survey activities described in the survey plan.

The Lessee must submit a survey plan to the Lessor at least 90 calendar days prior to commencement of any survey activities described in the survey plan. Within 30 calendar days from receipt, the Lessor may request the Lessee modify the survey plan to address any comments the Lessor submits to the Lessee on the contents of the survey plan. Comments must be addressed by the Lessee in a manner deemed satisfactory by the Lessor prior to commencement of the survey activities. If the Lessor does not respond with comments or objections within 30 calendar days of receipt of the survey plan, the Lessee may proceed with the survey activities per the proposed schedule. The lack of Lessor comment or objection to the survey plan does not ensure acceptance of the survey results with the SAP and/or RAP. If the Lessee is proposing a fisheries survey that could result in the take of species listed under the Endangered Species Act, additional time should be allowed for consultation and/or permits authorizing the activity.

3.3.6.2 Monthly Survey Reports

Monthly reporting of raw PSO data collected during geophysical survey activities must be submitted to BOEM (renewable_reporting@boem.gov) and BSEE (via TIMS Web Portal and protectedspecies@bsee.gov) by the PSO provider on the 15th of each month for each vessel conducting

survey work. Any editing, review, and quality assurance checks must be completed only by the PSO provider prior to submission to BOEM and ensure use of standard field codes and formats (**Appendix A**). Monthly data reporting from all PSO observations must be recorded based on standard PSO collection and reporting requirements. PSOs must use standardized electronic data forms to record data. The PSOs may record data electronically in data collection software, but the data fields listed below must be recorded and exported to an Excel file for submittal. Alternatively, BOEM has developed an Excel spreadsheet with all the necessary data fields that is available upon request.

3.3.6.3 Final Survey Reports

Final survey reports must be submitted to BOEM in coordination with PSOs within 90 calendar days following completion of a survey. Final reports must contain all survey activity included under each submitted survey plan, but include individual vessel departure and return ports, PSO names and training certifications, the PSO provider contact information, dates of the survey, a vessel track, a summary of all PSO documented sightings of protected species, survey equipment shutdowns that occurred, any vessel strike-avoidance measures taken, takes of protected species that occurred, and any observed injured or dead protected species. The DOI will work with the Lessee to ensure that DOI does not release confidential business information found in the monitoring reports.

3.3.6.4 Instructions for Geophysical Survey Reports

The following data fields for PSO reports of geological and geophysical surveys must be reported in Excel format (.xml file) along with metadata defining all data fields.

Survey Information:

- Project name
- Lease number
- State coastal zones
- Survey contractor
- Survey type
- Reporting start and end dates
- Visual monitoring equipment used (e.g., bionics, magnification, IR cameras);
- Distance finding method used
- PSO names (last, first), training certification, and affiliation
- PSO location and observation height above sea surface

Operations Information:

- Vessel name(s)
- Sound sources including equipment type, power levels, and frequencies used
- Greatest RMS source level
- Dates of departures and returns to port with port name

Monitoring Effort Information:

- Date (YYYY-MM-DD)

- Source status at time of observation (on/off)
- Number of PSOs on duty
- Start time of observations for each shift in UTC (YY-MM-DDT HH:MM)
- End time of observations for each shift in UTC (YY-MM-DDT HH:MM)
- Duration of visual observations of protected species
- Weather
- Wind speed (knots), direction (cardinal direction)
- Beaufort sea state
- Water depth (meters)
- Visibility (km)
- Glare severity related to monitoring area (none, slight, moderate, extreme)
- Time pre-clearance visual monitoring began in UTC (YY-MM-DDT HH:MM)
- Time pre-clearance monitoring ended in UTC (YY-MM-DDT HH:MM)
- Duration of pre-clearance visual monitoring
- Time of day of pre-clearance began (day/night)
- Time power-up/ramp-up began
- Time equipment full power was reached
- Duration of power-up/ramp-up (if conducted)
- Time survey activity began (equipment on) in UTC
- Time survey activity ended (equipment off) in UTC
- Survey duration
- Did a shutdown/power-down occur?
 - Time shutdown was called for (UTC)
 - Time equipment was shut down (UTC)
- Vessel location (latitude/longitude, decimal degrees) when survey effort begins and ends; vessel location at beginning and end of visual PSO duty shifts; recorded at :30 intervals if obtainable from data collection software
- Habitat or prey observations (narrative)
- Marine debris sightings (narrative)

Detection Information (in addition to the Survey, Operation, and Monitoring fields)

- Date (YYYY-MM-DD)
- Sighting ID (multiple sightings of the same animal or group should use the same ID)
- Time at first detection in UTC (YY-MM-DDT HH:MM)
- Time at last detection in UTC (YY-MM-DDT HH:MM)

- PSO name(s) (last, first) on duty
- Observer location
- Number of observers on duty
- Watch status (on effort PSO, off effort PSO, opportunistic, crew, alternate vessel/platform)
- Effort (ON=device on; OFF=device off)
- Start time of observations
- End time of observations
- Location of vessel when detection occurs: Latitude and Longitude (decimal degrees)
- Compass heading of vessel (degrees)
- Beaufort sea state
- Wind speed (knots/direction)
- Swell height (meters)
- Weather/precipitation
- Visibility (kilometers)
- Cloud coverage (%)
- Glare severity related to monitoring area (none, slight, moderate, extreme)
- Species (Species Code)
- Certainty of identification
- Number of adults (high, low, best)
- Number of juveniles (high, low, best)
- Total number of animals or estimated group size
- Sighting cue (Blow, Breach, White water, Flukes, Body)
- Bearing to animal(s) when first detected (ship heading in degrees + clock face direction to animal)
- Distance determination method (use code)
- Distance from vessel at first detection (e.g., reticle distance in meters)
- Description of unidentified animals (include features such as overall size; shape of head; color and pattern; size, shape, and position of dorsal fin; height, direction, and shape of blow, etc.)
- Detection narrative (note behavior, especially changes in relation to survey activity and distance from source vessel)
- Direction of travel/first approach (relative to vessel)
- Behaviors observed: indicate behaviors and behavioral changes observed in sequential order (use behavioral codes)
- If any bow-riding behavior observed, record total duration during detection (YY-MM-DDT HH:MM)
- Initial heading of animal(s) (ship heading in degrees + clock face direction to animal)

- Final heading of animal(s) (ship heading in degrees + clock face direction to animal)
- Shutdown zone size during detection (meters)
- Was the animal inside the shutdown zone? (Y/N)
- Closest distance to vessel (reticle distance in meters)
- Time at closest approach (UTC YY-MM-DDT HH:MM)
- Time animal entered shutdown zone (UTC YY-MM-DDT HH:MM)
- Time animal left shutdown zone (UTC YY-MM-DDT HH:MM)
- If observed/detected during ramp-up/power-up: first distance (reticle distance in meters), closest distance (reticle distance in meters), last distance (reticle distance in meters), behavior at final detection
- Did a shutdown/power-down occur? (Y/N)
- Time shutdown was called for (UTC)
- Time equipment was shut down (UTC)

3.3.6.5 Protected Species Incident Reporting

Protected Species Incident Reporting. Regardless of survey type or the need to provide a dedicated trained watch stander or PSO, any potential take, strikes, or dead/injured protected species caused by Project activities must be reported to the NMFS GARFO Protected Resources Division (nmfs.gar.incidental-take@noaa.gov), NOAA Fisheries 24-hour Stranding Hotline – for marine mammals from Maine-Virginia, report to (866) 755-6622, and from North Carolina-Florida to (877) 942-5343 and for sea turtles from Maine-Virginia, report to (866) 755-6622, and from North Carolina-Florida to (844)732-8785. BOEM (renewable_reporting@boem.gov), and BSEE (via TIMS and protectedspecies@bsee.gov) as soon as practicable, but no later than 24 hours from the time the incident took place (Protected Species Incident Report). The Protected Species Incident Report must include the following information:

- Contact info for the person providing the report;
- Time, date, and location (latitude/longitude) of the incident;
- Species identification (if known) or description of the animal(s) involved;
- Condition of the animal(s) (e.g., live, injured, dead);
- Observed behaviors of the animal(s), if alive;
- If available, photographs or video footage of the animal(s); and
- General circumstances (e.g., vessel speed/direction of travel, sound sources in use) under which the animal was impacted.

3.3.6.6 Dead or Injured Protected Species Reporting

All dead or injured protected species must be reported to NMFS, BOEM, and BSEE regardless of whether they were observed during operations or directly due to Lessee activities. In the event that an injured or dead marine mammal or sea turtle is sighted, regardless of the cause, the Lessee must report the incident to the NMFS Protected Resources Division (nmfs.gar.incidental-take@noaa.gov),

NMFS 24-hour Stranding Hotline number (866-755-6622), BOEM (renewable_reporting@boem.gov), and BSEE (protectedspecies@bsee.gov) as soon as practicable (taking into account crew and vessel safety), but no later than 24 hours from the sighting (Dead or Injured Protected Species Report). Staff responding to the hotline call will provide any instructions for the handling or disposing of any injured or dead protected species by individuals authorized to collect, possess, and transport sea turtles. The Protected Species Incident Report must include the following information:

- Time, date, and location (latitude/longitude) of the first discovery (and updated location information if known and applicable);
- Species identification (if known) or description of the animal(s) involved;
- Condition of the animal(s) (including carcass condition if the animal is dead);
- Observed behaviors of the animal(s), if alive;
- If available, photographs or video footage of the animal(s); and
- General circumstances under which the animal was discovered.

3.3.6.7 Reporting of All NARW Sightings

The Lessee must immediately report all NARWs observed to BOEM and BSEE; the NOAA Fisheries 24-hour Stranding Hotline number (866-755-6622); the Coast Guard (via telephone at (617) 223-5757 or via Channel 16); and WhaleAlert. The report must include the time, location, and number of animals sighted.

3.3.7 Entanglement Avoidance

Ensure any mooring systems used during data collection activities are designed to prevent potential entanglement or entrainment of listed species, and in the unlikely event that entanglement does occur, ensure proper reporting of entanglement events according to the measures specified below:

1. Ensure that any buoys attached to the seafloor use the best available mooring systems. Buoys, lines (chains, cables, or coated rope systems), swivels, shackles, and anchor designs must prevent any potential entanglement of listed species while ensuring the safety and integrity of the structure or device. All mooring lines and ancillary attachment lines must use one or more of the following measures to reduce entanglement risk: shortest practicable line length, rubber sleeves, weak-links, chains, cables, or similar equipment types that prevent lines from looping, wrapping, or entrapping protected species.
2. Any equipment must be attached by a line within a rubber sleeve for rigidity. The length of the line must be as short as necessary to meet its intended purpose.
3. When practicable, buoys should be lowered and raised slowly to minimize risk to listed species and benthic habitat. No buoys should be deployed or retrieved if large whales or sea turtles are sighted within 1,640 ft (500 m) of the buoy being deployed/retrieved.
4. If a live or dead marine protected species becomes entangled, operators must immediately contact the applicable stranding network coordinator using the reporting contact details (see Reporting Requirements section) and provide any on-water assistance requested.
 - a. All buoys must be properly labeled with owner and contact information.

3.3.8 Benthic Habitat and Ecosystem Monitoring Conditions

All vessel anchoring and any seafloor-sampling activities are restricted from seafloor areas with deep/cold-water coral reefs and shallow/mesophotic reefs. All vessel anchoring and seafloor sampling must also occur at least 492 ft (150 m) from any known locations of threatened or endangered coral species. All sensitive live bottom habitats (eelgrass, cold-water corals, etc.) should be avoided as practicable. All vessels in coastal waters will operate in a manner to minimize propeller wash and seafloor disturbance and transiting vessels should follow deep-water routes (e.g., marked channels), as practicable, to reduce disturbance to sturgeon habitat. Additionally, no geotechnical or bottom disturbing activities will take place during the spawning/rearing season within freshwater reaches of rivers where Atlantic or shortnose sturgeon spawning occurs. Any survey plan that includes geotechnical or other benthic sampling activities in freshwater reaches (salinity 0 to 0.5 ppt) of such rivers will identify a time of year restriction that will avoid such activities during the time of year when Atlantic sturgeon spawning and rearing of early life stages occurs in that river. Time of year restrictions included in the PDCs in **Appendix A** only occur in the Hudson and Delaware Rivers, both of which are outside the Action Area (Figure 3-1) and therefore not applicable for the Proposed Action.

3.3.8.1 Benthic Survey Plan

The Lessee must provide a Benthic Survey Plan prior to completion of the RAP to NMFS-GARFO, BOEM, and BSEE. The Lessee must review all NOAA and DOI comments on the Plans. The Lessee must provide to DOI the revised Fisheries Research Monitoring Plan and Benthic Survey Plan and written responses for all NOAA comments not addressed in the Benthic Survey Plan. DOI will review the revised Benthic Survey Plan and written responses from the Lessee for all NOAA comments not addressed in the Benthic Survey Plan, and provide comments, if any, to the Lessee within 45 days of their submittal to DOI. The Lessee must resolve all comments on revisions to the Benthic Survey Plan to DOI's satisfaction prior to implementation of the revised Benthic Survey Plan.

3.3.9 Fishery Monitoring Conditions for Endangered and Threatened Species

The Lessee must ensure that the fisheries monitoring survey plan design follows the Fisheries Survey Guidelines (Fisheries Guidelines, updated 27 March 2023; BOEM 2023). The Fisheries Guidelines provides guidance for standardizing survey plan design and aims to reduce the risk of interactions between protected species and sampling gear by minimizing the amount of gear fished (i.e., set or towed), the gear soak or tow duration, and the spatial and temporal overlap with protected species.

3.3.9.1 Best practices for trap/pot/gillnet gear

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

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

- a. No surface floating buoy lines will be used.
- b. All groundlines will be composed of sinking line.
- c. Buoy lines will use weak links (less than 1,700-pound [771-kilogram] breaking strength).
- d. Gillnet strings will be anchored with a Danforth-style anchor with a minimum holding strength of 22 lb (10 kg).
- e. Knot-free buoy lines will be used to the extent practicable.

3.3.9.2 Gear Marking

The Lessee must ensure that all trap/pot and gillnet gear used in fishery surveys is uniquely marked to distinguish it from other commercial or recreational gear. Marked gear must use yellow and black striped duct tape, placed along a 3-foot-long mark within 12 ft (3.66 m) 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.

3.3.9.3 Sampling Times

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

3.3.9.4 Lost gear

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

3.3.9.5 Observer Training

The Lessee must ensure all fisheries survey 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) or similar training program (program must be reviewed and deemed acceptable by NMFS GARFO and DOI) 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.

3.3.9.6 Disentanglement Protocols

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

3.3.9.6.1 Sea turtle and sturgeon protocols

The Lessee must ensure any sea turtles or Atlantic sturgeon caught and/or retrieved in any fisheries survey gear are identified to species or species group and reported to DOI via email to BOEM (renewable_reporting@boem.gov), BSEE (via TIMS), and NMFS Greater Atlantic Regional Fisheries Office, Protected Resources Division (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. Biological data, samples, and tagging must occur as outlined below:

The Lessee must follow the Sturgeon and Sea Turtle Take Standard Operating Procedures (NMFS 2021b).

1. The Lessee must equip survey vessels with a passive integrated transponder (PIT) tag reader onboard capable of reading 134.2 kHz and 125 kHz encrypted tags (e.g., Biomark GPR Plus Handheld PIT Tag Reader), and this reader must be used to scan any captured sea turtles and sturgeon for tags. Any recorded tags must be recorded on the take reporting form 10 and reported to DOI via email to BOEM (via TIMS), BSEE, (OSWSubmittals@bsee.gov), and NMFS Greater Atlantic Regional Fisheries Office, Protected Resources Division (nmfs.gar.incidental-take@noaa.gov).
 - a. The Lessee must take genetic samples from all captured Atlantic sturgeon (alive or dead) to allow for identification of the distinct population segment (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.
 - b. 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 DOI via email to BOEM (renewable_reporting@boem.gov), BSEE (via TIMS) and NMFS Greater Atlantic Regional Fisheries Office, Protected Resources Division (nmfs.gar.incidental-take@noaa.gov) within 6 months of the sample collection.
 - c. 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.
2. The Lessee must ensure all captured sea turtles and Atlantic sturgeon are documented with required measurements, photographs, body condition, and descriptions of any marks or injuries. This information must be entered as part of the record for each capture. An NMFS Take Report Form must be filled out for each individual sturgeon and sea turtle and submitted to DOI via email to BOEM (renewable_reporting@boem.gov), BSEE (via TIMS), and NMFS Greater Atlantic Regional Fisheries Office, Protected Resources Division (nmfs.gar.incidental-take@noaa.gov).
3. 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:
4. To the extent allowed by sea conditions, the Lessee must give priority to the handling and resuscitation of any sea turtles or sturgeon that are captured in the gear being used. Handling times for these species should be minimized (i.e., kept to 15 minutes or less) to limit the amount of stress placed on the animals.
5. 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. These handling and resuscitation procedures must be executed any time a sea turtle is incidentally captured and brought onboard a survey vessel.
 - a. 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), the Coast Guard should be contacted via VHF marine radio on Channel 16. If required, hard-shelled sea turtles (i.e., non-leatherbacks) may be held on board for

- up to 24 hours, provided that conditions during holding are authorized by the NMFS Greater Atlantic Regional Fisheries Office, Protected Resources Division and safe handling practices are followed. If the hotline or an available veterinarian cannot be contacted and the injured animal cannot be taken to a rehabilitation center, activities that could further stress the animal must be stopped. When sea-to-shore contact with the hotline or an available veterinarian is not possible, the animal must be allowed to recover and be responsive before safely releasing it to the sea.
- b. 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.
 - c. 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.
6. The Lessee must notify DOI via email to BOEM (renewable_reporting@boem.gov), BSEE (via TIMS), and NMFS Greater Atlantic Regional Fisheries Office, Protected Resources Division (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. 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 (GPS) coordinates describing the location of the interaction (in decimal degrees); (3) gear type involved (e.g., bottom trawl, gillnet, longline); (4) soak time, gear configuration and any other pertinent gear information; (5) time and date of the interaction; (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.

3.3.9.7 Fisheries Survey Reporting

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

4 ESA-listed Species and Critical Habitat in the Action Area

4.1 ESA-listed Species in the Action Area

Table 4-1 presents all ESA-listed species and associated designated critical habitat that occur within the Action Area.

Table 4-1. ESA-listed species and designated critical habitat that may be affected by the Proposed Action

Species	ESA Status	Critical Habitat	Recovery Plan
Marine Mammals – Cetaceans			
Blue whale (<i>Balaenoptera musculus</i>)	E-35 FR 18319	-- --	FR Not Available 07/1998 11/2020
Fin whale (<i>Balaenoptera physalus</i>)	E-35 FR 18319	-- --	75 FR 47538 07/2010
North Atlantic right whale (<i>Eubalaena glacialis</i>)	E-73 FR 12024	81 FR 4837	70 FR 32293 08/2004
Sei whale (<i>Balaenoptera borealis</i>)	E-35 FR 18319	-- --	FR Not Available 12/2011
Sperm whale (<i>Physeter macrocephalus</i>)	E-35 FR 18319	-- --	75 FR 81584 12/2010
Sea Turtles			
Green turtle (<i>Chelonia mydas</i>) – North Atlantic DPS	T-81 FR 20057	-- -- ¹	FR Not Available 10/1991–U.S. Atlantic
Kemp's Ridley turtle (<i>Lepidochelys kempii</i>)	E-35 FR 18319	-- --	FR Not Available 09/1991–U.S. Caribbean, Atlantic, and Gulf of Mexico 09/2011
Leatherback turtle (<i>Dermochelys coriacea</i>)	E-35 FR 8491	-- -- ²	FR Not Available 10/1991–U.S. Caribbean, Atlantic, and Gulf of Mexico
Loggerhead turtle (<i>Caretta caretta</i>) – Northwest Atlantic Ocean DPS	T-76 FR 58868	-- -- ³	74 FR 2995 10/1991–U.S. Caribbean, Atlantic, and Gulf of Mexico 01/2009–Northwest Atlantic
Fishes			
Atlantic salmon (<i>Salmo salar</i>) – Gulf of Maine DPS	E-74 FR 29344 and 65 FR 69459	74 FR 39903	70 FR 75473 11/2005 FR Not Available 02/2019
Atlantic sturgeon (<i>Acipenser oxyrinchus oxyrinchus</i>) – Carolina, Chesapeake, Gulf of Maine, New York Bight, South Atlantic DPSs	E-77 FR 5913	82 FR 39160	03/2018 ⁴
Giant manta ray (<i>Manta birostris</i>)	T-83 FR 2916	-- --	12/2019 ⁴

Species	ESA Status	Critical Habitat	Recovery Plan
Oceanic whitetip shark (<i>Carcharhinus longimanus</i>)	T-83 FR 4153	-- --	09/2018 ⁴
Shortnose sturgeon (<i>Acipenser brevirostrum</i>)	E-32 FR 4001	-- --	63 FR 69613 12/1998

-- -- = not applicable; DPS = distinct population segment; E = endangered; F = foreign; FR = Federal Register; T = Threatened

¹ Green sea turtle critical habitat (63 FR 46693) is established outside of the Action Area.

² Leatherback sea turtle critical habitat (44 FR 17710 in the Atlantic and 77 FR 4169 in the Pacific) is established outside of the Action Area.

³ Loggerhead sea turtle critical habitat (79 FR 39856) is established outside of the Action Area.

⁴ No Recovery Plan is available for this species. However, NMFS has developed a Recovery Outline to serve as interim guidance for this species until a full Recovery Plan is developed.

4.2 ESA-listed Species Considered but Excluded from Further Analysis

Several species have broad ranges that may include the Action Area but are not likely to be affected by the Proposed Action. The following ESA-listed species were considered for their potential to occur in the Action Area but were excluded from further analysis: blue whale (*Balaenoptera musculus*), giant manta ray (*Manta birostris*), oceanic whitetip shark (*Carcharhinus longimanus*), and shortnose sturgeon (*Acipenser brevirostrum*). These species were excluded from further analysis because the potential for adverse effects from the Proposed Action were determined to be extremely unlikely to occur and, therefore, **discountable**³. Explanations for discounting potential effects for these species are provided in the following subsections.

4.2.1 Marine Mammals

4.2.1.1 Blue Whale (Endangered)

The documented range of blue whales in the North Atlantic extends from the subtropics to the Greenland Sea. As described in the most recent stock assessment report, blue whales have been detected and tracked acoustically in much of the North Atlantic Ocean, with most acoustic detections around the Grand Banks area of Newfoundland and west of the British Isles (Hayes et al. 2020). Photo-identification in eastern Canadian waters indicates blue whales from the St. Lawrence River, Newfoundland, Nova Scotia, Northeast U.S., and Greenland all belong to the same stock, whereas blue whales photographed off Iceland and the Azores appear to be part of a separate population (Cetacean and Turtle Assessment Program [CETAP] 1982; Wenzel et al. 1988; Sears and Calambokidis 2002; Sears and Larsen 2002). The largest concentrations of blue whales are found in the lower St. Lawrence Estuary (Lesage et al. 2007; Comtois et al. 2010), which is outside of the Action Area. Blue whales do not regularly occur within the U.S. Exclusive Economic Zone (EEZ), typically occurring farther offshore in depths of 328 ft (100 m) or more (Waring et al. 2012). Sightings and strandings data indicate blue whales occur along the U.S. East Coast only rarely because their primary habitat is offshore eastern Canada (Reeves et al. 1998; Kraus et al. 2016a; Hayes et al. 2020). Blue whales primarily feed on krill, but fish and copepods may also be part of their diet (NMFS 2023b).

³ *Discountable* effects are those that are extremely unlikely to occur, which supports a *not likely to adversely affect* determination. For an effect to be discountable, there must be a plausible adverse effect (i.e., a credible effect that could result from the action and would be an adverse effect if it did impact an ESA-listed species), but it is extremely unlikely to occur.

Blue whales have been listed as endangered under the ESA Endangered Species Conservation Act of 1969, with a recovery plan published under 63 *FR* 56911. Blue whales are separated into two major populations (North Pacific and North Atlantic) and further subdivided into stocks. The North Atlantic Stock includes mid-latitude (North Carolina coastal and open ocean) to Arctic waters (Newfoundland and Labrador). The population size of blue whales off the U.S. East Coast is not known; however, a catalogue count of 402 individuals from the Gulf of St. Lawrence is the minimum population estimate (Hayes et al. 2020). There are no recent confirmed records of anthropogenic mortality or serious injury to blue whales in the U.S. Atlantic EEZ or in Atlantic Canadian waters (Henry et al. 2020). As a result, the total level of anthropogenic mortality and serious injury is unknown, but it is believed to be insignificant and approaching zero (Hayes et al. 2020). No critical habitat has been designated for the blue whale.

Historical observations indicate the blue whale has a wide distribution throughout the North Atlantic Ocean, from warm temperate latitudes in the winter months to northern regions in the summer months. Blue whales are known to be an occasional visitor to U.S. Atlantic EEZ waters, with limited sightings. Blue whales in the North Atlantic appear to target high-latitude feeding areas and may use deep-ocean features such as sea mounts outside the feeding season (Pike et al. 2009; Lesage et al. 2017, 2018). Given their reported occurrence and habitat preferences, their presence in the Action Area is expected to be rare (Hayes et al. 2020). Additionally, sightings and strandings data indicate blue whales occur along the U.S. East Coast continental shelf rarely, typically exhibiting a more pelagic distribution (Kraus et al. 2016a; Lesage et al. 2017). Blue whales have been reported in the Gulf of Maine and a known individual was resighted between the Gulf of Maine, Scotian Shelf, and Gulf of St. Lawrence (Hayes et al. 2020). However, given their habitat preferences and rare usage of the Action Area, the potential for adverse effects from the Proposed Action is **discountable**.

4.2.2 Marine Fishes

4.2.2.1 Giant Manta Ray (Threatened)

The giant manta ray (*Manta birostris*) is the world's largest ray and can be found worldwide in tropical, subtropical, and temperate waters between 35°N and 35°S latitudes. They primarily feed on planktonic organisms, including euphausiids and copepods (NMFS 2022a). The giant manta ray was listed as threatened throughout its range under the ESA in 2018 (83 *FR* 2916). Commercial fishing is the primary threat to the giant manta ray as it is targeted and caught as bycatch in several global fisheries throughout its range (NMFS 2022a). Based on a comprehensive review of the best scientific data available, there are no identifiable PBFs essential to conservation of the giant manta ray within U.S. jurisdiction (84 *FR* 66652). Therefore, no areas within U.S. jurisdiction meet the definition of critical habitat for the giant manta ray (84 *FR* 66652). As a result, NMFS determined a designation of critical habitat for the giant manta ray was not prudent.

In the western Atlantic Ocean, this includes South Carolina to Brazil. Giant manta rays travel long distances during seasonal migrations and may be found in upwelling waters at the shelf break. The species may also follow warm Gulf Stream water intrusions into areas north of 35°N, typically in late summer and early fall when sea surface temperatures are the highest (Farmer et al. 2022). Sighting records of giant manta rays in the Mid-Atlantic and New England are rare, but individuals have been observed as far north as New Jersey (Miller and Klimovich 2017) and Block Island (Gudger 1922). Given this, their occurrence within the Action Area is considered very rare and they are unlikely to be encountered.

Giant manta rays in the Action Area would only be encountered during proposed Project vessel transits, so the only risk considered in this BA for this species are vessel strikes and discharges. While they do not surface to breathe, as a planktivorous elasmobranch, rays (including the giant manta ray) can spend considerable time in surface waters for basking and feeding where they are more susceptible to vessel

strikes (McGregor et al. 2019). They show little reaction toward vessels, which can also make them vulnerable to vessel strikes, especially from fast-moving recreational vessels (Deakos 2011; C. Horn, NMFS, personal observation). However, the co-occurrence of proposed Project vessels and individual giant manta rays within the Acton Area is expected to be highly unlikely based on the very low potential for occurrence in waters north of 35°N, including the Gulf of Maine, and the expected low number of vessel transits that may pass through suitable manta ray habitat. Given this, the likelihood of an encounter resulting in a ship strike is extremely low. Additionally, the mitigation and monitoring measures proposed for all proposed Project vessels that include dedicated watch personnel to monitor for species and active vessel avoidance for all protected species, including giant manta rays, and adherence to federally regulated marine spills and discharges rule would further reduce the chance of any adverse effects on the species from the Proposed Action during vessel transits. Additionally, given the brief transit encounter periods and marine debris and pollution abatement measures, effects from proposed Project vessel discharges would also be extremely low. Therefore, the likelihood of any potential adverse effects resulting from the Proposed Action is, therefore, **discountable**.

4.2.2.2 Shortnose Sturgeon (Endangered)

The shortnose sturgeon (*Acipenser brevirostrum*) is an anadromous species, spawning and growing in fresh water and foraging in both the estuary of its natal river and shallow marine habitats close to the estuary (Bain 1997; Fernandes et al. 2010). Shortnose sturgeon occur in the Northwest Atlantic Ocean but are typically found in freshwater or estuarine environments. Historically, the species was found in coastal rivers along the entire east coast of North America. Because of threats such as habitat degradation, water pollution, dredging, water withdrawals, fishery bycatch, and habitat impediments (e.g., dams), the species was listed as endangered in 1967 (32 *FR* 4001) throughout the entire population range.

Shortnose sturgeon are found in large rivers and estuaries along the North American eastern seaboard from the Indian River in Florida to the Saint John River in New Brunswick, Canada. Generally, spawning occurs far upstream in their natal rivers, with individuals moving downriver to the estuaries to feed, rest, and spend most of their time. They are a primarily benthic species and are rarely known to leave their natal freshwater rivers (Kieffer and Kynard 1993); therefore, their presence in the marine environment is uncommon (Baker and Howsen 2021). Movement of shortnose sturgeon between rivers is rare, though there have been some reported migrations (Shortnose Sturgeon Status Review Team 2010).

Within the Action Area, shortnose sturgeon occur in the Penobscot River and Kennebec River (Altenritter et al. 2018). During spawning season, it is common for sturgeon to migrate from the Penobscot to the Kennebec, though not vice versa, and as reproduction has thus far only been observed in the Kennebec River, it has been hypothesized that most sturgeon from these two rivers originate from the Kennebec River (Altenritter et al. 2018; Dionne et al. 2013). Sturgeon that migrate were found to grow larger and faster than those solely in the Penobscot River, indicating the productive benefits of migration between the rivers (Altenritter et al. 2018). Migrations have been found throughout the year, with an average trip of 12 days in the spring, 13.2 days in the fall, and 36.7 days in the summer, with likely movements through the coastal Maine river and bay system (Altenritter et al. 2018; Dionne et al. 2013). These patterns indicate that time spent in the marine environment and within the Action Area remains very low. Shortnose sturgeon have also been found entering coastal rivers between the Penobscot and Kennebec, though few east of the Penobscot River (Dionne et al. 2013). Though there is some possibility that Project vessels may encounter shortnose sturgeon within the Action Area, given their life history, behaviors, and low usage of the Action Area, the likelihood of an interaction is considered very small, and the potential for adverse effects from the Proposed Action is **discountable**.

4.2.2.3 Oceanic Whitetip Shark (Threatened)

The oceanic whitetip shark, listed as threatened in 2018 (83 *FR* 4153), can be found globally in tropical and warm-temperate waters. The species is typically found in water temperatures between 59°F and 82°F (15°C and 28°C), though is most common in waters warmer than 68°F (20°C) (Bonfil et al. 2008; Carlson and Gulak 2012; Tolotti et al. 2015; NMFS 2023c). It is a pelagic species with a preference for open ocean waters but can also be found on the OCS or around oceanic islands in waters deeper than 604 ft (184 m) (NMFS 2023c). Oceanic whitetip sharks typically are found in open ocean waters between 10° N and 10° S, but can be found in decreasing numbers out to latitudes of 30° N and 30° S, with abundance decreasing with greater proximity to continental shelves (Young et al. 2017). In the Western Atlantic Ocean, oceanic whitetip sharks occur from Maine to Argentina, including the Caribbean and Gulf of Mexico. In the Northwest Atlantic Ocean, they are most commonly observed south of Virginia, though records of occurrence include the Mid-Atlantic and northeast U.S. (Kohler et al. 1998; Young and Carlson 2020; Vaudo et al. 2022). The overall range of the species in the North Atlantic Ocean expands northward during the summer and fall in response to seasonally warmer temperatures and increased prey availability (Vaudo et al. 2022). Oceanic whitetip sharks are unlikely to be encountered in the Action Area; and occurrences would be very rare given their preference for warm open ocean waters. Due to the low probability of this species occurring in the Action Area, the potential for adverse effects from the Proposed Action is **discountable**.

4.3 Critical Habitat Considered but Excluded from Further Analysis

4.3.1 Atlantic Salmon Critical Habitat – Gulf of Maine DPS

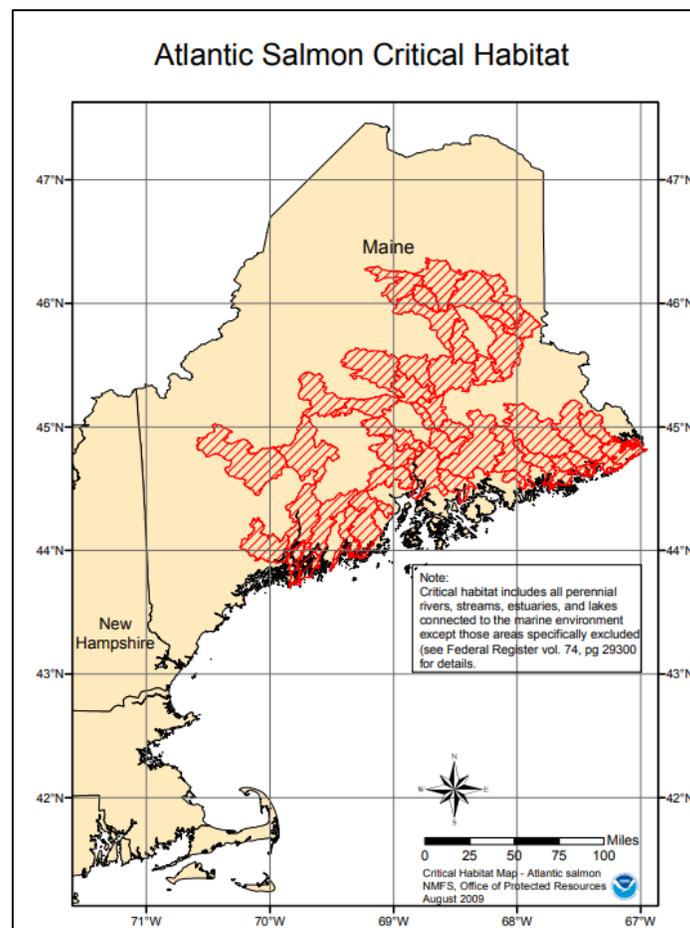
Critical habitat for the Atlantic Salmon Gulf of Maine DPS was designated in June 2009 (74 *FR* 29300) and updated in August 2009 (74 *FR* 39903). This area is entirely made up of inland Maine waters that serve as critical areas for spawning, nursery and feeding grounds, and migration corridors to and from offshore marine waters. The FR determined that the successful return of adult salmon to spawning habitat, spawning, egg incubation and hatching, juvenile survival during the rearing time in freshwater, and smolt migration out of the rivers to the ocean are all essential to the conservation of Atlantic salmon. No marine habitats were identified as critical habitat because marine migration and feeding in these habitats essential for the conservation of Atlantic salmon could not be identified.

This habitat constitutes 12,273 mi (19,751 km) of river, stream, and estuary habitat, as well as 308.5 mi² (799 km²) of lake which lies adjacent to the Action Area (**Figure 4-1**). The physical and biological features identified for spawning and rearing include (1) deep, oxygenated pools and cover (e.g., boulders, woody debris, vegetation, etc.), near freshwater spawning sites, necessary to support adult migrants during the summer while they await spawning in the fall; (2) freshwater spawning sites that contain clean, permeable gravel and cobble substrate with oxygenated water and cool water temperatures to support spawning activity, egg incubation, and larval development; (3) freshwater spawning and rearing sites with clean, permeable gravel and cobble substrate with oxygenated water and cool water temperatures to support emergence, territorial development, and feeding activities of Atlantic salmon fry; freshwater rearing sites (4) with space to accommodate growth and survival of Atlantic salmon parr; (5) with a combination of river, stream, and lake habitats that accommodate parr's ability to occupy many niches and maximize parr production; (6) with cool, oxygenated water to support growth and survival of Atlantic salmon parr; and (7) with diverse food resources to support growth and survival of Atlantic salmon parr.

The physical and biological features necessary for migration of Atlantic salmon include freshwater and estuary migratory sites (1) free from physical and biological barriers that delay or prevent access of adult salmon seeking spawning grounds needed to support recovered populations; (2) with pool, lake, and instream habitat that provide cool, oxygenated water and cover items (e.g., boulders, woody debris, and

vegetation) to serve as temporary holding and resting areas during upstream migration of adult salmon; (3) with abundant, diverse native fish communities to serve as a protective buffer against predation; (4) free from physical and biological barriers that delay or prevent emigration of smolts to the marine environment; (5) with sufficiently cool water temperatures and water flows that coincide with diurnal cues to stimulate smolt migration; and (6) with water chemistry needed to support sea water adaptation of smolts.

The majority of the Action Area is outside of this critical habitat; however, Project vessels in the Action Area may enter the critical habitat via the recommended vessel route west of Boothbay Harbor in the Sheepscot River. The other recommended vessel route is Penobscot Bay, which is adjacent to the critical habitat. It is not expected that vessels will transit upriver and enter designated Atlantic salmon critical habitat. Additionally, no activities that would disturb any of the identified PBFs would occur within or adjacent to any rivers with designated Atlantic salmon critical habitat. Therefore, the potential for adverse effects from the Proposed Action is **discountable**.



Source: <https://www.fisheries.noaa.gov/resource/map/atlantic-salmon-gulf-maine-dps-critical-habitat-map-and-gis-data>

Figure 4-1. Map identifying designated critical habitat for the Atlantic Salmon DPS

4.3.2 Atlantic Sturgeon Critical Habitat – All Listed DPS

Five separate DPSs of Atlantic sturgeon were listed under the ESA in 2012 (77 *FR* 5880; 77 *FR* 5914): Chesapeake Bay (endangered), Carolina (endangered), New York Bight (endangered), South Atlantic (endangered), and Gulf of Maine (threatened). The final rule for Atlantic sturgeon critical habitat (all listed DPS) was issued in 2017 (82 *FR* 39160). Included in this rule are 31 units, all rivers, occurring from Maine to Florida (**Figure 4-2**). Critical habitat designations for the Atlantic sturgeon Gulf of Maine DPS encompasses five rivers in Maine, New Hampshire, and Massachusetts; Units 1 through 5 occur within the Action Area (**Figure 4-3**). No marine habitats were identified as critical habitat because the physical and biological features in these habitats essential for the conservation of Atlantic sturgeon could not be identified.

The critical habitat designation (82 *FR* 39160) for all DPSs is for habitats that support successful Atlantic sturgeon reproduction and recruitment. The physical features essential for Atlantic sturgeon reproduction and recruitment and therefore to the conservation of the Gulf of Maine, New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs (NMFS 2017) include: (1) hard-bottom substrate (e.g., rock, cobble, gravel, limestone, boulder, etc.) in low salinity waters (i.e., 0.0 to 0.5 ppt range) for settlement of fertilized eggs, refuge, growth, and development of early life stages; (2) aquatic habitat with a gradual downstream salinity gradient of 0.5 up to as high as 30 ppt and soft substrate (e.g., sand, mud) between the river mouth and spawning sites for juvenile foraging and physiological development; (3) water of appropriate depth and absent physical barriers to passage (e.g., locks, dams, thermal plumes, turbidity, sound, reservoirs, gear, etc.) between the river mouth and spawning sites necessary to support unimpeded movements of adults to and from spawning sites, seasonal and physiologically dependent movement of juvenile Atlantic sturgeon to appropriate salinity zones within the river estuary, and staging, resting, or holding of subadults or spawning condition adults; and (4) water quality conditions between the river mouth and spawning sites, especially in the bottom meter of the water column, with the temperature, salinity, and oxygen values that, combined, support spawning, annual and interannual adult, subadult, larval, and juvenile survival, and larval, juvenile, and subadult growth, development, and recruitment (e.g., 13° C to 26° C for spawning habitat and no more than 30° C for juvenile rearing habitat, and 6 mg/L or greater dissolved oxygen for juvenile rearing habitat).

Project vessel transits throughout the Action Area includes the Penobscot River, which is part of the Gulf of Maine DPS critical habitat, Unit 1. The Action Area also has the potential for vessel transit through Units 2 and 3 of the Gulf of Maine DPS critical habitat, though no transit is planned for the New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPS. Project activities are not expected to disturb or alter any essential PBFs within this critical habitat given the limited extent of overlap between vessel transit routes and the critical habitat.

Vessel ports located identified under the Proposed Action are in the vicinity of the Atlantic sturgeon Gulf of Maine DPS rivers designated as critical habitat. Recommended vessel transits are near rivers (Units 1-3) where Atlantic sturgeon critical habitat are located; however, any ports used in this area would be outside of the critical habitat boundaries. Additionally, no activities that would disturb any of the identified PBFs would occur within or adjacent to any rivers with designated Atlantic sturgeon critical habitat. Therefore, the potential for adverse effects from the Proposed Action is **discountable**.

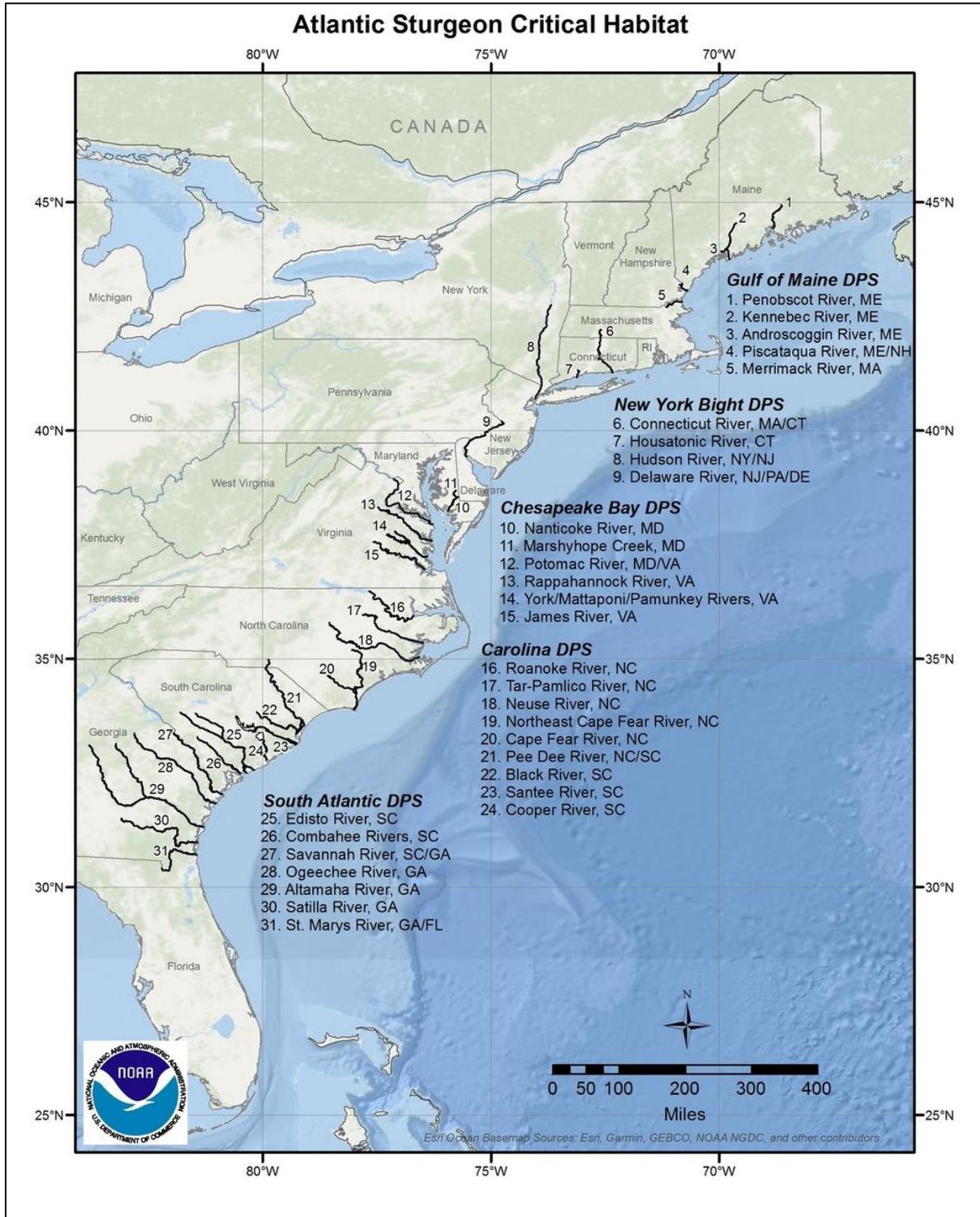
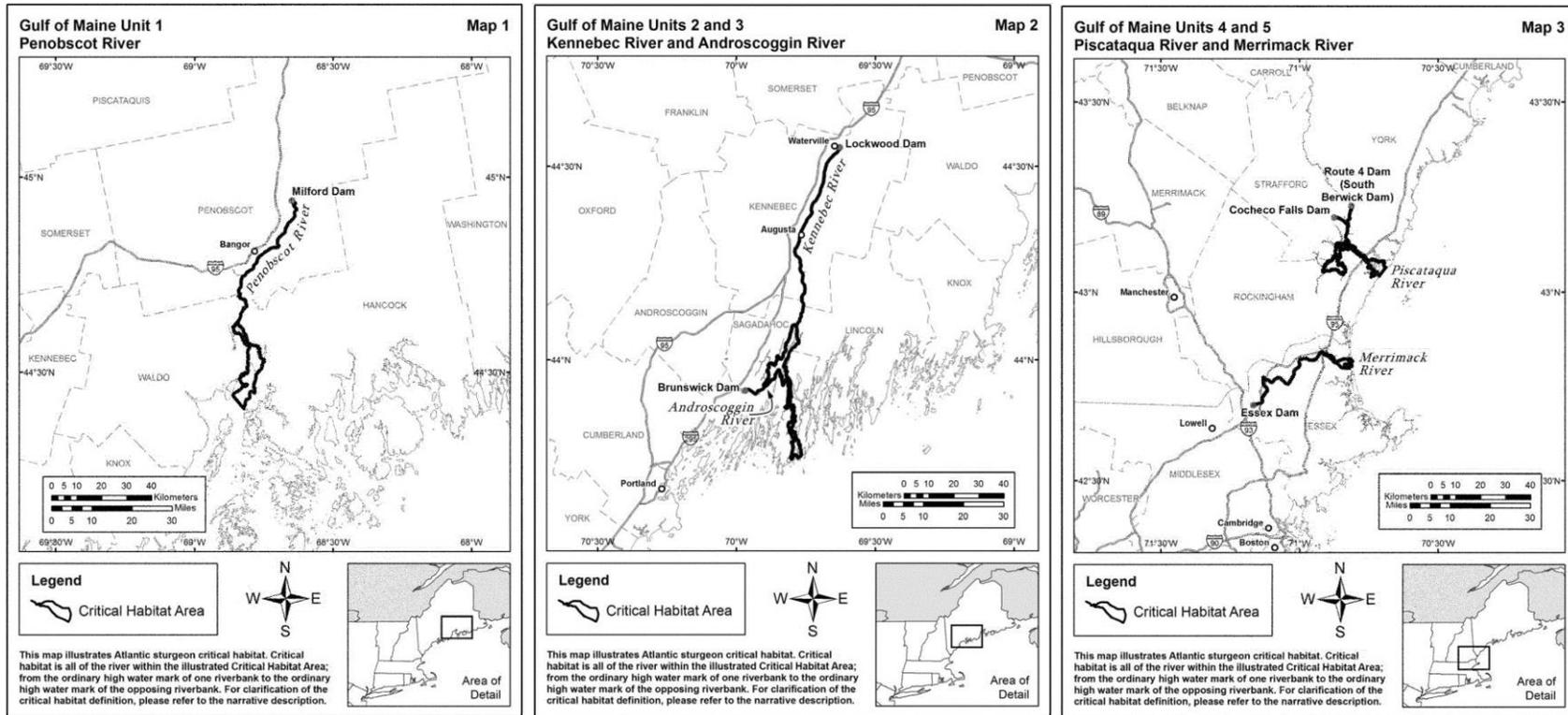


Figure 4-2. Map identifying designated critical habitat for the Atlantic sturgeon



Source: 82 FR 39160

Figure 4-3. Atlantic sturgeon Gulf of Maine Units 1–5 critical habitat

5 Description of Species and Critical Habitat Considered for Further Analysis

5.1 ESA-listed Species LAA or Species Considered for Further Analysis

BOEM has determined that the following species are likely to be adversely affected by the Proposed Action and thus require further analysis: fin whale–Western North Atlantic DPS (*Balaenoptera physalus*); North Atlantic right whale–Western North Atlantic DPS; sei whale–Nova Scotia DPS (*Balaenoptera borealis*); sperm whale–North Atlantic DPS (*Physeter macrocephalus*); green sea turtle–North Atlantic DPS; Kemp’s ridley sea turtle (*Lepidochelys kempii*); leatherback sea turtle (*Dermochelys coriacea*); loggerhead sea turtle–Northwest Atlantic Ocean DPS; Atlantic Salmon–Gulf of Maine DPS (*Salmo salar*); and Atlantic sturgeon–All DPSs. The following subsections discuss the habitat, foraging preferences, acoustic behavior, status, and occurrence of each ESA-listed species considered for further analysis.

5.1.1 Marine Mammals

Four species of ESA-listed marine mammals are carried forward in this assessment. Habitat-based marine mammal density data (Roberts et al. 2022) was analyzed for each species. Mean monthly species densities (in number of animals per square kilometer) within the Action Area are presented in **Table 5-1**. The data (visualized through the heatmap applied to the table) are used to assess seasonal and relative distribution patterns for NARW, fin, sei, and sperm whales within the Action Area.

Table 5-1. Monthly marine mammal mean densities (individuals per square kilometer) within the Action Area

	January	February	March	April	May	June	July	August	September	October	November	December	Yearly Average
NARW	0.00129	0.00082	0.00080	0.00131	0.00058	0.00017	0.00021	0.00003	0.00001	0.00053	0.00131	0.00051	0.00063
Fin	0.00250	0.00162	0.00138	0.00173	0.00394	0.00541	0.00575	0.00637	0.00458	0.00384	0.00263	0.00297	0.00356
Sei	0.00010	0.00008	0.00018	0.00113	0.00282	0.00145	0.00047	0.00033	0.00057	0.00155	0.00133	0.00032	0.00086
Sperm	0.00006	0.00005	0.00004	0.00002	0.00003	0.00008	0.00012	0.00014	0.00021	0.00008	0.00004	0.00005	0.00008

Data source: Roberts et al. 2022

Note: Table cell colors correspond to relative geographic and temporal densities assessed for from January through December for each species, individually. Warm colors (i.e., red) indicate months of highest relative density whereas cool colors (i.e., green) indicate months of lowest relative density.

5.1.1.1 Fin Whale –Western North Atlantic Distinct Population Segment (Endangered)

Fin whales are a globally distributed baleen whale species found in temperate to polar regions in all ocean basins (Edwards et al. 2015). The western North Atlantic stock is concentrated in the U.S. and Canadian Atlantic Exclusive Economic Zones from Cape Hatteras to Nova Scotia (Hayes et al. 2020) and is therefore the most likely source of individuals occurring in the Action Area. Fin whales are the most commonly sighted large whale species in this region, accounting for 46 percent of all sightings in aerial surveys conducted from 1978 to 1982 (CETAP 1982; Hayes et al. 2018) and constitute the majority of large whale sightings in recent aerial and shipboard surveys (NEFSC and SEFSC 2018; Kraus et al. 2016a). They have been observed in every season throughout most of their range, though densities do vary seasonally (Edwards et al. 2015). While they prefer the deeper waters of the continental shelf (300 to 600 ft [91 to 183 m]), they are regularly observed anywhere from coastal to abyssal areas (Hayes et al. 2020).

Fin whales are the second largest cetacean, with adults in the North Atlantic reaching lengths up to 78.7 ft (24 m). Fin whales are fast swimmers typically found in social groups of two to seven, often congregating with other whales in large feeding groups (Hayes et al. 2017). The species returns annually to established feeding areas and fasts during migration between feeding and calving grounds. Fin whales in the North Atlantic feed on krill (*Meganyctiphanes norvegica* and *Thysanoessa inermis*) and schooling fish such as capelin (*Mallotus villosus*), herring (*Clupea harengus*), and sand lance (*Ammodytes* spp.), captured by skimming or lunge feeding (Borobia et al. 1995). The Gulf of Maine represents one of the main feeding grounds for fin whales, where they preferentially forage on small schooling fish such as herring, sand lance, young mackerel, and krill (DMR 2022b) Several studies suggest that distribution and movements of fin whales along the east coast of the U.S. are influenced by the availability of sand lance (Kenney and Winn 1986; Payne et al. 1990). Some level of site fidelity among females at their feeding grounds likely exist (Clapham and Seipt 1991; Agler et al. 1993; Schleimer et al. 2019). While fin whales likely migrate into Canadian waters, deep offshore areas, or tropical latitudes, distinct, population-wide large-scale annual migrations are unlikely (Hayes et al. 2022). Data suggests that calving may take place from October through January in the Mid-Atlantic region (Hain et al. 1992), though calving, mating, and wintering patterns for the majority of the population remain unknown. The fin whale's ecological role and influence on ecosystem processes surpasses that of all other cetacean species in the Western North Atlantic due to their large stock size and prey requirements (Hain et al. 1992; Kenney et al. 1997). Biologically important areas (BIA) for feeding have been delineated for the area east of Montauk Point, New York from March to October; the Southern Gulf of Maine year-round; and the Northern Gulf of Maine from June to October (LaBrecque et al. 2015).

Fin whales and other baleen whales belong to the low-frequency cetacean (LFC) marine mammal hearing group, which has a generalized hearing range of 7 hertz (Hz) to 35 kHz (NMFS 2018). The predicted best hearing sensitivity of fin whales is believed to range from 20 HZ to 20 kHz (Erbe 2002; Southall et al. 2019).

5.1.1.1.1 Current Status

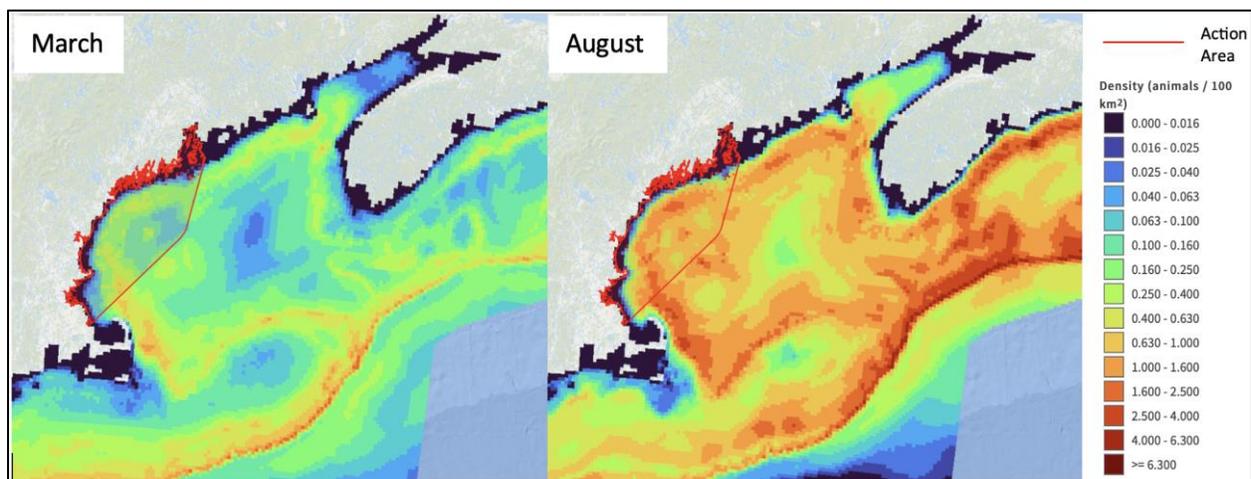
Fin whales have been listed as endangered under the ESA since the act's passage in 1973 (35 FR 8491), and critical habitat has not been designated. The best available abundance estimate for the western North Atlantic stock is 6,802 individuals, with a minimum population estimate of 5,573 based on shipboard and aerial surveys conducted in 2016 and the 2016 Northeast Fisheries Science Center and Department of Fisheries and Oceans Canada surveys (Hayes et al. 2022). The extents of these two surveys do not overlap; therefore, the survey estimates were added together. NMFS has not conducted a population trend analysis due to insufficient data and irregular survey design (Hayes et al. 2022). The best available information indicates that the gross annual reproduction rate is 8 percent, with a mean calving

interval of 2.7 years (Hayes et al. 2022). For 2015 through 2019, the minimum annual rate of human-caused (i.e., vessel strike and entanglement in fishery gear) mortality and serious injury was 1.85 per year (Hayes et al. 2022). No critical habitat has been designated for fin whales in the Action Area.

5.1.1.1.2 Potential Occurrence Within the Action Area

Fin whales are one of the most commonly sighted large whales in OCS waters from the Mid-Atlantic coast of the U.S. to Nova Scotia, principally from Cape Hatteras, North Carolina and northward (Sergeant 1977; Sutcliffe and Brodie 1977; CETAP 1982, Hain et al. 1992; NMFS 2019). The Gulf of Maine, including the Action Area, represents an important foraging area for fin whales; two BIAs for fin whale feeding occur within the Action Area (LaBrecque et al. 2015). There is also evidence for maternally-directed site fidelity over multiple years in the Gulf of Maine (Clapham and Seipt, 1991). Fin whales can be expected to occur in the Action Area year round, particularly in the southern portion of the Action Area, with highest abundances during summer and fall (MGEL 2022). All life stages of fin whales could be encountered in the Action Area.

Habitat-based marine mammal density data indicate the highest densities throughout the Action Area would most likely occur in August and the lowest in March (Figure 5-1; Roberts et al. 2022). The temporal and geographic distribution of fin whale densities within the Action Area is presented in Table 5-1; the data indicate that, while fin whales are widespread throughout the Gulf of Maine throughout the year, they are likely to occur in highest densities during the summer.



Source: Roberts et al. 2022

Figure 5-1. Fin whale minimum (March) and maximum (August) mean densities within the Action Area and surrounding region

5.1.1.2 North Atlantic Right Whale – Western North Atlantic Distinct Population Segment (Endangered)

The North Atlantic right whale (NARW) (*Eubalaena glacialis*) is a large baleen whale, ranging from 45 to 55 ft (13.7 to 16.8 m) in length and weighing up to 70 tons at maturity, with females being larger than males. The primary habitat for this species is coastal or OCS waters ranging from calving grounds off the Southeastern U.S. to feeding grounds off the Northeastern U.S. (NMFS 2023a). Important feeding habitats include coastal waters off southern New England, Gulf of Maine, Bay of Fundy, Scotian Shelf, and Gulf of St. Lawrence.

There are two critical habitat areas for NARWs in Canadian waters (Brown et al. 2009) and two in U.S. waters: all U.S. waters within the Gulf of Maine are designated as a Foraging Area Critical Habitat while waters off the Southeastern U.S. are designated as a Calving Area Critical Habitat (81 *FR* 4837; NMFS 2023a). The Mid-Atlantic OCS between the two U.S. critical habitat areas has been identified as a principal migratory corridor and thus an important habitat for NARWs as they travel between breeding and feeding grounds (NMFS 2023a; CETAP 1982). This migratory pathway is considered a BIA for the species (LaBrecque et al. 2015). While some individuals undergo yearly migrations between spending summer months at their northern feeding grounds and winter months at their southern breeding grounds, the location of most individuals throughout much of the year is poorly understood. Year-round presence in all habitat areas has been recorded (Bailey et al. 2018; Davis et al. 2017). In addition, long-range movements are also apparent, with some individuals being identified in the eastern North Atlantic and others covering long distances over short time periods (NMFS 2023a).

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 their foraging grounds is highly correlated with concentrations and distributions of their prey, which exhibit high variability within and between years (Pendleton et al. 2012). Due to the heightened energetic requirements of pregnant and nursing females, yearly reproductive success of the population is directly related to foraging success and the abundance of *C. finmarchicus* (Meyer-Gutbrod et al. 2015), which in turn is correlated with decadal-scale variability in climate and ocean patterns (Greene and Pershing 2000).

Skim feeding is an important activity identified in effects assessments because it demonstrates a critical behavior (feeding) that could be disrupted by external stressors. Baumgartner et al. (2017) investigated NARW foraging ecology in the Gulf of Maine and southwestern Scotian Shelf using archival tags; diving behavior was variable but followed distinct patterns correlated with the vertical distribution of forage species in the water column. Importantly, Baumgartner et al. (2017) found that NARWs spent 72 percent of their time within 33 ft (10 m) of the surface. Although NARWs are always at risk of ship strike when breathing, the tendency to forage near but below the surface for extended periods substantially increases this risk (Baumgartner et al. 2017). NARW feeding behavior varies by region in response to different seasonal and prey availability conditions. For example, NARWs may rely more frequently on skim-feeding when in transit between core habitats or when dense concentrations of prey are less available (Whitt et al. 2013). Similarly, right whales spend extended periods of time at the water's surface actively socializing in what are known as surface active groups (SAGs); SAGs have been documented in all habitat regions, during all seasons, involve all age classes, and include mating behaviors, play, and the maintenance of social bonds (Parks et al. 2007). The extensive and biologically critical surface behaviors of NARWs, such as surface skim feeding and SAGs, represent a vulnerable time for right whales as they are exposed to an increased risk for ship strike when active at or near the surface.

The diversity of zooplankton across the Northeast U.S. Continental Shelf is relatively high (greater than 100 species), although seasonal and interannual trends in abundance differ among species (NEFSC n.d.; Johnson et al. 2014; DFO 2017). Seasonal trends in overall zooplankton abundance have been detected over the shelf waters of southern New England, ranging from relatively low densities (0.73 to 1.4 cubic inches per 2.4 cubic mile) in January through February to relatively high densities (greater than 3.36 cubic inches per 2.4 cubic mile) during May through August (NEFSC n.d.). These trends are also present for *C. finmarchicus*, which is also an important food source for many fish species, including NARWs. On average, *C. finmarchicus* has been the most abundant during the spring and summer (March through August), with a peak density in May through June along the Northeast U.S. Shelf (NEFSC n.d.). Overall, average zooplankton densities have been remarkably consistent over the past 20 years, though interannual variability is present. Mean total density for *C. finmarchicus* along the Northeast U.S. Shelf

varied greatly from year to year, commonly halving or doubling from one year to the next (NEFSC n.d.). Results from Runge et al. (2015) and Ji et al. (2017) specify that predicting fluctuations in abundance or circumstances for disappearance of *C. finmarchicus* in the northwest Atlantic would require models that address the roles of local production and advection.

NARW distribution and pattern of habitat use has shifted both spatially and temporally beginning in 2010 (Davis et al. 2017). Meyer-Gutbrod et al. (2018) recorded NARW sightings in several traditional feeding habitats beginning to decline in 2012, causing speculation that a shift in NARW habitat usage was occurring (Pettis et al. 2022). An increased presence of NARWs in the Gulf of St. Lawrence beginning in 2015 further supports a shift in habitat use, potentially in response to shifting prey resources as a result of climate change (Crowe et al. 2021; Meyer-Gutbrod et al. 2015, 2021). Additionally, a recent increase in habitat use and year-round presence in the southern New England region, including Nantucket Shoals, indicates that the area is an increasingly important NARW habitat (O'Brien et al. 2022). These data and literature therefore collectively suggest that NARW habitat use, including changes in their distribution patterns linked to prey resources, is dynamic and likely related to climate change processes.

NARW and other baleen whales belong to the LFC marine mammal hearing group, which has a generalized hearing range of 7 Hz to 35 kHz (NMFS 2018). Right whale vocalizations most frequently observed during PAM studies include upsweeps rising from 30 to 450 Hz, often referred to as “upcalls,” and broadband (30 to 8,400 Hz) pulses, or “gunshots,” with SLs between 172 and 187 dB re 1 μ Pa m (Erbe et al. 2017). However, recent studies have shown that mother-calf pairs reduce the amplitude of their calls in the calving grounds, possibly to avoid detection by predators (Parks et al. 2019). Modeling conducted using right whale ear morphology suggest that the best hearing sensitivity for this species is between 16 Hz and 25 kHz (Ketten et al. 2014; Southall et al. 2019).

5.1.1.2.1 Current Status

NARWs in U.S. waters belong to the Western Atlantic stock. “Stock” is defined by the MMPA as a group of individuals “of the same species or smaller taxa in a common spatial arrangement that interbreed when mature” (16 USC § 1362.11). The NARW is listed as endangered under the ESA and critically endangered by the IUCN Red List (Cooke 2020; NMFS 2023a). Right whales are considered to be one of the most critically endangered large whale species in the world (NMFS 2023a). The Western North Atlantic population size was estimated to be 338 individuals in the most recent draft 2022 SAR, which used a hierarchical, state-space Bayesian open population model of sighting histories from the photo-identification recapture database through November 2022 (NMFS 2023a). Between 2011 and 2020, the population has declined in overall abundance by 29.7 percent, further evidenced by the decrease in the abundance estimate from 451 in 2018 (NMFS 2023a) to the current 2021 estimate of 338 individuals (NMFS 2023a). This decline in abundance follows a previous positive population trend from 1990 to 2011 that saw an increase of 2.8 percent per year from an initial abundance estimate of 270 individuals in 1998 (NMFS 2023a). Over time, there have been periodic swings of per capita birth rates (NMFS 2023a), although current birth rates continue to remain below expectations (Pettis et al. 2022), with an approximately 40 percent decline in reproductive output for the species since 2010 (Kraus et al. 2016b). Eighteen new calves were sighted during the 2021 calving season (Pettis et al. 2022), an increase from 10 calves observed in 2020, and 12 new calves have been sighted so far for the 2023 calving season (NMFS 2023d). Although the increasing birth rate is a beneficial sign, it is still significantly below what is expected, and the rate of mortality is still higher than what is sustainable (Pettis et al. 2022; NMFS 2023d). A reduction in adult female survival rates relative to male survival rates has caused a divergence between male and female abundance.

Net productivity rates do not exist as the Western North Atlantic stock lacks any definitive population trend (NMFS 2023a). The average annual human-related mortality/injury rate exceeds that of the calculated PBR of 0.7, and due to its listing as endangered under the ESA this population is classified as

strategic and depleted under the MMPA (NMFS 2023a). Estimated human-caused mortality and serious injury between 2016 and 2020 was 8.1 whales per year, of which 5.7 whales per year are attributed to fisheries interactions and the remainder 2.4 whales per year cause by vessel strike (NMFS 2023g). However, it is likely that not all mortalities are documented and it is estimated that only one-third of mortalities are actually recorded (NMFS 2023a). Modeling suggests that the mortality rate for the period from 2014 to 2018 may be up to 27.4 animals (NMFS 2023a; Pace 2021). There have been elevated numbers of mortalities reported since 2017, which prompted NMFS to designate an Unusual Mortality Event (UME) for NARWs (NMFS 2023e). These elevated mortalities have continued into 2023, totaling 36 mortalities, 22 serious injuries, and 39 sublethal injuries or illness (NMFS 2023e). Based on the mortalities for which the carcasses could be examined, preliminary analyses indicate that all mortalities are likely to be human-caused, predominantly from entanglement in fishing gear or vessel collisions (NMFS 2023e). Of the 36 mortalities, 12 have been identified as resulting from vessel strikes and 9 from entanglements (NMFS 2023e). Although many of the mortalities have occurred in Canadian waters, the U.S. population is not separated from those in Canada; therefore, the effects of mortality affect the population considered in the assessment process. While vessel strikes and entanglements in fishing gear represent the most significant threat to NARWs, other risks to the population include acoustic disturbance and masking, climate change, and climate-driven shifts in prey species (NMFS 2023a).

To mitigate the potential for vessel strikes, NMFS designated certain nearshore waters along the U.S. East Coast as Seasonal Management Areas (SMAs) (73 *FR* 60173). These management areas are in effect seasonally and established such that all vessels greater than 65 ft (19.8m) in overall length must operate at speeds of 10 kn or less within these areas. Portions of existing NARW SMAs overlap with the southern portion of the Action Area:

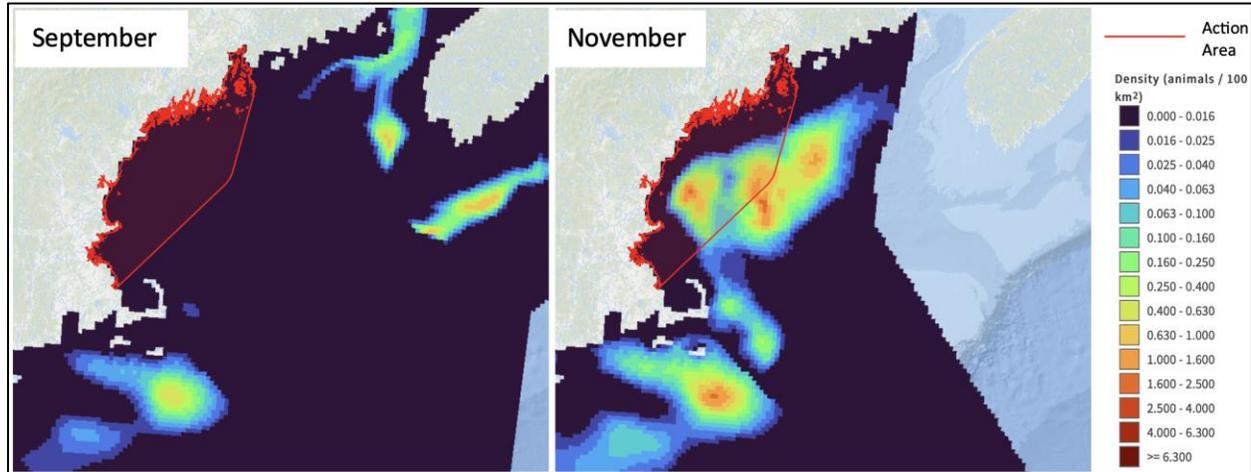
- Cape Cod Bay SMA – January 1 to May 15
- Off Race Point SMA – March 1 to April 30

Amendments to the NARW speed rule (Proposed Rule, 87 *FR* 46921) would decrease the size of vessels required to comply with the 10-knot speed restriction to 35 ft (10.7m) and expand the geographic areas to regional sections rather than immediately surrounding ports and transit corridors. While the southern portion of the Action Area would overlap with the Atlantic zone, the Action Area would fall just outside of these zones.

5.1.1.2.2 Potential Occurrence Within the Action Area

NARWs are common in the Gulf of Maine; visual and acoustic surveys indicate that NARWs may be present year-round in the Gulf of Maine, though the highest abundances occur from mid-fall through early summer (NMFS 2023a; MGEL 2022; Davis et al. 2017). The species is less commonly observed in the Action Area during July, August, and September when they are more likely to be in the Bay of Fundy (outside of the Action Area) or in more northern feeding grounds such as the Gulf of St. Lawrence (Pendleton et al. 2012; Kraus et al. 2016a; Leiter et al. 2017; Crowe et al. 2021). The Gulf of Maine represents an important foraging habitat for the NARW; the unique bathymetric features of the Gulf of Maine support dense aggregations of their preferred prey. NARWs typically arrive to the Gulf of Maine in the early spring and enter Cape Cod Bay, where large dispersed groups, including mothers with their offspring, are commonly sighted. From mid-spring through early summer, individuals move out of Cape Cod Bay to utilize other areas of the Gulf of Maine, Bay of Fundy, Scotian Shelf, and Gulf of St. Lawrence. While these movement patterns are generalized, satellite data indicate that individuals are highly mobile and can exhibit sporadic large scale movement patterns between sighting events. Therefore, individuals may occur within the Action Area throughout the year, even when predicted densities are expected to be low.

Habitat-based marine mammal density data indicate the highest densities throughout the Action Area would most likely occur in November and the lowest in September (**Figure 5-2**; Roberts et al. 2022). The temporal and geographic distribution of NARW densities within the Action Area is presented in **Table 5-1**; the data indicate that, while NARW may occur year-round in the Gulf of Maine, they are likely to occur in highest densities during the winter and spring.



Source: Roberts et al. 2022

Figure 5-2. NARW minimum (September) and maximum (November) mean densities within the Action Area and surrounding region

There continue to be shifts in NARW abundances and feeding activity; and more uncertainty in foraging patterns should be expected through the entirety of the Proposed Action (Hudak et al., 2023; Ross et al., 2023). There are several planned and ongoing acoustic studies for NARWs in the Gulf of Maine to better understand shifts in abundances (<https://www.fisheries.noaa.gov/new-england-mid-atlantic/endangered-species-conservation/passive-acoustic-research-atlantic-ocean>).

5.1.1.3 Sei Whale – Nova Scotia Distinct Population Segment (Endangered)

The sei whale is a large baleen whale species found in subtropical, temperate, and subpolar waters around the globe, most commonly observed in temperate waters at mid-latitudes. Sei whales are often associated with deeper waters and areas along the continental shelf edge (Hain et al. 1985); however, this general offshore pattern of sei whale distribution is disrupted during occasional incursions into more shallow and inshore waters (Waring et al. 2004). Sightings in U.S. Atlantic waters are typically centered on mid-shelf and the shelf edge and slope (Olsen et al. 2009). The species is notable for its unpredictable distribution, concentrating in specific areas in large numbers for a period and then abandoning those habitats for years or even decades. The breeding and calving areas used by this species are unknown (Hayes et al. 2022).

This species is highly mobile, and there is no indication that any population remains in a particular area year-round (NMFS 2011). Sei whale occurrence in any particular feeding ground is considered unpredictable or irregular (Schilling et al. 1992) but may be correlated to incursions of relatively warm waters related to broadscale oceanographic circulation patterns (Hayes et al. 2022). Olsen et al. (2009) also indicated that sei whales' movements appear to be associated with oceanic fronts, thermal boundaries, and specific bathymetric features. NMFS (2011) indicated that climate change may affect sei whale habitat availability and food availability, as migration, feeding, and breeding locations may be affected by ocean currents and water temperature.

Sei whales usually travel alone or in small groups of two to five animals, occasionally in groups as large as 10 (Hayes et al. 2022). Potential species occurrence in the Action Area is likely to be closely tied to feeding behavior and seasonal availability of preferred prey resources. Sei whales in the North Atlantic preferentially prey on calanoid copepods, particularly *Calanus finmarchicus*, over all other zooplankton species (Christensen et al. 1992; NMFS 2011; Prieto et al. 2014). Data indicate that sei whales have a clear preference for copepods between June and October, with euphausiids constituting a larger part of the diet in May and November (NMFS 2011; Prieto et al. 2014). They also feed on small schooling fish and cephalopods, including squid. Sei whales prefer to feed at dawn and may exhibit unpredictable behavior while foraging and feeding on prey (NMFS 2023f). Their feeding behaviors include gulping, skimming, and lunging at the surface.

Sei whales are occasionally killed in collisions with vessels. Of three sei whales that stranded along the U.S. Atlantic coast between 1975 and 1996, two showed evidence of collisions with ships (Laist et al. 2001). Between 1999 and 2005, there were three reports of sei whales being struck by vessels along the Atlantic coast of the U.S. and the maritime provinces of Canada (Cole et al. 2005; Nelson et al. 2007). Two of these vessel strikes were reported as having resulted in the death of the sei whale.

Sei whales and other baleen whales belong to the LFC hearing group of marine mammals, which has a generalized hearing range of 7 Hz to 35 kHz (NMFS 2018). Peak hearing sensitivity of sei whales is believed to range from 1.5 to 3.5 kHz based on recorded vocalization patterns (Erbe 2002).

5.1.1.3.1 Current Status

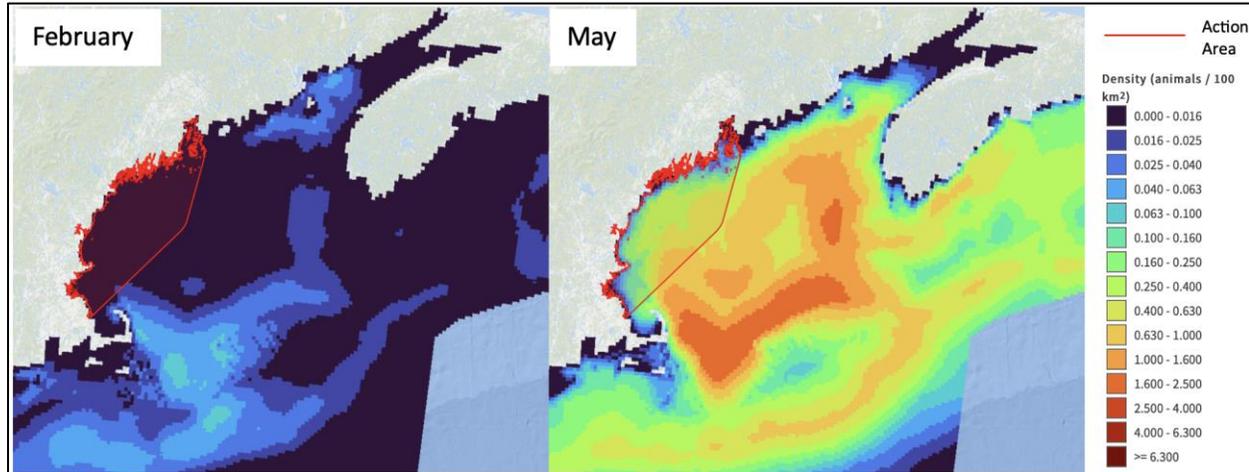
Sei whales have been ESA-listed as endangered at the species level since the passage of the act in 1973 (35 FR 8491). Sei whales occurring in the U.S. Atlantic EEZ belong to the Nova Scotia stock, which range from the northeast U.S. coast northward to south of Newfoundland throughout continental shelf waters (Hayes et al. 2022). The current best abundance estimate for this stock is 6,292 individuals (Hayes et al. 2022). Between 2015 and 2019, the average annual minimum human-caused mortality and serious injury was 0.8 sei whales per year (Hayes et al. 2022). Threats to sei whales include vessel strike and entanglement in fisheries gear. A population trend are not available for the Nova Scotia sei whale stock because of insufficient data (Hayes et al. 2022). This stock is listed as strategic and depleted under the MMPA due to its endangered status (Hayes et al. 2022). The PBR for this stock is 6.2, and annual human-caused mortality and serious injury from 2015 to 2010 was estimated to be 0.8 per year (Hayes et al. 2022). No critical habitat has been designated for sei whales in the Action Area.

5.1.1.3.2 Potential Occurrence Within the Action Area

Sei whales are typically distributed in deep waters in association with the shelf edge throughout their range, though incursions into shallower OCS waters occurs, generally in response to oceanographic patterns and prey availability (Hain et al. 1985; Hayes et al. 2022). Sei whales are present in the Action Area primarily during spring and summer, though they have been observed year-round near the shelf break (Palka et al. 2021). Available data suggest sei whales primarily occur in deeper shelf waters in the southern and eastern portions of the Action Area near the shelf break, only occasionally traveling closer to shore to feed (Palka et al. 2021; Hayes et al. 2022; Roberts et al. 2022). The Gulf of Maine is primarily used for foraging; however the sei whale preference for cooler waters (less than 10°C) indicate that preferential feeding grounds may be in decline and populations would be in flux (Hayes et al. 2022). Passive acoustic analyses supports this with records showing that sei whales had a higher acoustic occurrence after 2010 in the Mid-Atlantic (Davis et al. 2020).

Low numbers of sei whales are expected to be encountered within the Action Area, with highest likelihood in offshore waters beyond the 100-m isobath; however, variable patterns in distribution could result in very high or very low encounter rates for any given year (Hayes et al., 2022).

Habitat-based marine mammal density data indicate the highest densities throughout the Action Area would most likely occur in May and the lowest in February (Figure 5-3; Roberts et al. 2022). The temporal and geographic distribution of sei whale densities within the Action Area is presented in Table 5-1; the data indicate that, while sei whales may occur year-round in the Gulf of Maine, they are likely to occur in highest densities during the spring and fall.



Source: Roberts et al. 2022

Figure 5-3. Sei whale minimum (February) and maximum (May) mean densities within the Action Area and surrounding region

5.1.1.4 Sperm Whale – North Atlantic Distinct Population Segment (Endangered)

The sperm whale is the largest member of the order Odontocetes, or toothed whales, with adults ranging from 39 to 59 ft (12 to 18 m) in length. Sperm whales occur throughout the world’s oceans. They can be found near the edge of the ice pack in both hemispheres and are also common along the equator. The North Atlantic stock is distributed mainly along the OCS-edge, over the continental slope, and mid-ocean regions, where they prefer water depths of 1,969 ft (600 m) or more and are less common in waters less than 984 ft (300 m) deep (Perry et al. 1999; Hayes et al. 2020). The stock exhibits a distinct seasonal cycle in U.S. Atlantic exclusive economic zone waters (Perry et al. 1999; Stanistreet et al. 2018). During the winter, sperm whales are observed east and northeast of Cape Hatteras, predominantly past the OCS edge (Hayes et al. 2020). In the spring, sperm whale distribution shifts north and they are more widely distributed throughout the Mid-Atlantic Bight and southern portions of George’s Bank (Hayes et al. 2020). Their summer distribution is similar to the spring, but with heightened occurrence inshore of the 328-foot (100-meter) isobath south of New England and in the Mid-Atlantic (Hayes et al. 2020). Sperm whale occurrence on the OCS in areas south of New England is at its highest in the fall, while occurrence in the Mid-Atlantic Bight is along the shelf edge (Hayes et al. 2020). The observed seasonality is likely driven by the distributions of their preferred prey (cephalopods), which may aggregate along distinct oceanographic features such as Gulf Stream eddies and temperature fronts in association with bathymetric features of the shelf edge (Waring et al. 1993; Jaquet and Whitehead 1996; Griffin 1999).

While deep water is their typical habitat, sperm whales have been observed near Long Island, New York, in water between 135 and 180 ft (41 and 55 m; Scott and Sadove 1997); and in the Gulf of Maine in 525 ft (160 m) water depths (Tran et al. 2014). When they are found relatively close to shore, sperm whales are usually associated with sharp increases in bottom depth where upwelling occurs and biological production is high, implying the presence of a good food supply (Clarke 1956).

Geographic distribution of sperm whales appears to be linked to social structure. Females and juveniles tend to congregate in matrilineal social groups in subtropical waters, whereas males range widely from the tropics to high latitudes and breed across social groups (Hayes et al. 2020). Sperm whales in the North Atlantic display sufficient genetic isolation from other Atlantic groupings to justify their identification as a breeding stock, but insufficient data are available to determine a definitive population structure (Waring et al. 2015).

Sperm whales are predatory specialists known for hunting prey in deep water. The species is among the deepest diving of all marine mammals. Males have been known to dive 3,936 ft (1,200 m), whereas females dive to at least 3,280 ft (1,000 m); both can continuously dive for more than 1 hour. Sperm whales are also relatively fast swimmers, capable of swimming at speeds of up to 20 miles per hour (9 m per second [m/s]) (Aoki et al. 2007). The species preferentially targets squid, which make up at least 70 percent of the whale's typical diet (Kawakami 1980; Pauly et al. 1998). Sperm whale are also known to prey on bottom-oriented organisms such as octopus, fish, shrimp, crab, and sharks (Leatherwood et al. 1982; Pauly et al. 1998).

Sperm whales belong to the mid-frequency cetacean (MFC) marine mammal hearing group, which has a generalized hearing range of 150 Hz to 160 kHz (NMFS 2018). Peak hearing sensitivity of sperm whales ranges from 5 to 20 kHz based on auditory brainstem response to recorded stimuli completed on a stranded neonate (Ridgway and Carder 2001). Sperm whales communicate and search for prey using broadband transient signals between 500 and 24 kHz, with most sound energy focused in the 2- and 9-kHz range (Lohrasbipeydeh et al. 2013).

5.1.1.4.1 Current Status

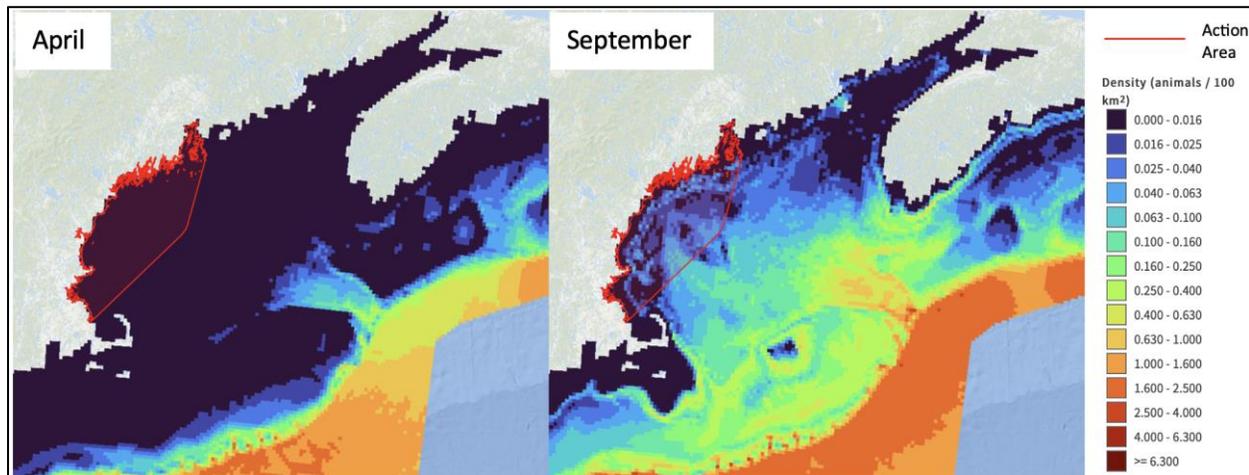
Sperm whales have been listed as endangered under the ESA since the initial passage of the act (35 *FR* 18319). The stock structure of the Atlantic population of sperm whales is poorly understood. It is not clear whether the western North Atlantic population is discrete from the eastern North Atlantic population (Hayes et al. 2020). However, the portion of the population found within the U.S. EEZ likely belongs to a larger stock in the western North Atlantic. The species was subjected to intense commercial whaling pressure in the 18th, 19th, and early 20th centuries, resulting in a prolonged and severe decline in abundance. Sperm whale populations are rebuilding after the cessation of commercial whaling on the species; the primary threats today are ship collisions and fishing gear entanglement (Hayes et al. 2020). The most recent abundance estimate for the North Atlantic stock is 4,349; between 1,000 to 3,400 of these individuals occur in U.S. (Hayes et al. 2020). However, this group is likely part of a larger western North Atlantic population, and that population may or may not be distinct from the eastern North Atlantic population (Hayes et al. 2020). There were no reports of fishery-related mortality or serious injury between 2013 and 2017, and while there were 12 strandings documented during this period, none showed any indications of human interaction (Hayes et al. 2020). No critical habitat has been designated for sperm whales in the Action Area.

5.1.1.4.2 Potential Occurrence Within the Action Area

Sperm whales are not common in the Action Area but are common at the shelf break in water depths of 656 to 3280 ft (200 to 1000 m), particularly in the area of the Northeast Channel with a year-round occurrence. The Gulf of Maine had the lowest abundance estimates for sperm whales during AMAPPS surveys compared to the shelf and offshore habitats along the US east coast (Palka et al. 2021). There were no sperm whale sightings along tracklines encompassing the Action Area during AMAPPS surveys conducted in 2016; and all acoustic detections displayed in the NMFS Passive Acoustic Cetacean Map are outside the Action area along the shelf. Habitat density models show year-round low densities in the Gulf of Maine with some increase into the Action Area during July to October (Roberts et al., 2022).

Given their habitat preferences, the sperm whale is considered relatively uncommon in shelf waters in the vicinity of the Action Area.

Habitat-based marine mammal density data indicate the highest densities throughout the Action Area would most likely occur in September and the lowest in April (Figure 5-4; Roberts et al. 2022). The temporal and geographic distribution of sperm whale densities within the Action Area is presented in Table 5-1; the data indicate that, while sperm whales may occur year-round in the Gulf of Maine, they are likely to occur in highest densities from summer to fall.



Source: Roberts et al. 2022

Figure 5-4. Sperm whale minimum (April) and maximum (September) mean densities within the Action Area and surrounding region

5.1.2 Sea Turtles

5.1.2.1 Green Sea Turtle – North Atlantic Distinct Population Segment (Threatened)

Green sea turtles have a worldwide distribution and can be found in both tropical and subtropical waters (NMFS and USFWS 1991; NatureServe 2023). They are the largest of the hard-shelled sea turtles, growing to a maximum length of approximately 4 ft (1.2 m) and weighing up to 440 pounds (200 kilograms [kg]) (NMFS and USFWS 1991). In the Western North Atlantic Ocean, the species can be found from Massachusetts to Texas as well as in waters off Puerto Rico and the U.S. Virgin Islands (NMFS and USFWS 1991). Depending on the life stage, green sea turtles inhabit high-energy oceanic beaches, convergence zones in pelagic habitats, and benthic feeding grounds in shallow protected waters (NMFS and USFWS 1991). They are most commonly observed feeding in shallow waters of reefs, bays, inlets, lagoons, and shoals that are abundant in algae or marine grass, such as eelgrass (NMFS and USFWS 2007a). Green sea turtles are known to make long-distance migrations between their nesting and feeding grounds. Individuals display fidelity for specific nesting habitats, which are concentrated in lower latitudes well south of the Action Area. The primary breeding areas in the U.S. are located in southeast Florida (NMFS and USFWS 1991). Nesting also occurs annually in Georgia, South Carolina, North Carolina, and Texas (NMFS 2023m). Hatchlings occupy pelagic habitats and are omnivorous. Juvenile foraging habitats include coral reefs, emergent rocky bottoms, *Sargassum* spp. mats, lagoons, and bays (USFWS 2023a). Once mature, green sea turtles leave pelagic habitats and enter benthic foraging grounds, primarily feeding on seagrasses and algae (Bjorndal 1997), although they will occasionally feed on sponges and invertebrates (NMFS 2023m).

Green sea turtles spend most of their lives in coastal foraging grounds, including open coastline waters (NMFS and USFWS 2007a). They often return to the same foraging grounds following periodic nesting migrations (Godley et al. 2002). However, some remain in the open ocean habitat for extended periods and possibly never recruit to coastal foraging sites (Pelletier et al. 2003). Once thought to be strictly herbivorous, more recent research indicates that this species also forages on invertebrates, including jellyfish, sponges, sea pens, and pelagic prey while offshore, and sometimes in coastal habitats (Heithaus et al. 2002).

Hatchling green sea turtles occupy pelagic habitats. Juveniles, upon reaching a carapace length of 20 to 25 cm, move to foraging habitats such as coral reefs, emergent rocky bottoms, *Sargassum* spp. mats, lagoons, and bays (Waring et al. 2012; USFWS 2023a). Once adults, green turtles will leave pelagic habitats and enter benthic foraging grounds (Bjorndal 1997). Available tagging and sighting data suggest green turtles generally prefer shallower waters (Palka et al. 2021). Juveniles are found more frequently than adults in the northeast Atlantic, migrating northward and residing in the New England area from May through November (NMFS 2022x).

Bartol and Ketten (2006) measured the auditory evoked potentials of two Atlantic green sea turtles and six sub adult Pacific green sea turtles. Sub-adults were found to respond to stimuli between 100 and 500 Hz, with a maximum sensitivity of 200 and 400 Hz. Juveniles responded to stimuli between 100 and 800 Hz, with a maximum sensitivity between 600 and 700 Hz. Piniak et al. (2016) found that the auditory evoked potentials of juvenile green sea turtles were between 50 and 1,600 Hz in water and 50 and 800 Hz in air, with ranges of maximum sensitivity between 50 and 400 Hz in water and 300 and 400 Hz in air.

5.1.2.1.1 Current Status

The green sea turtle was originally listed under the ESA in 1978 as threatened across its range. The listing was subsequently updated in 2016 (81 *FR* 20057), confirming threatened status across the range, with specific breeding populations in Florida and the Pacific Coast of Mexico listed as endangered (Seminoff et al. 2015). Individuals occurring within the Action Area belong to the North Atlantic DPS and is listed as threatened (81 *FR* 20057). The primary nesting beaches for the North Atlantic DPS of green sea turtles are Costa Rica, Mexico, U.S. (Florida), and Cuba. According to Seminoff et al. (2015), nesting trends are generally increasing for this DPS. The most recent status review for the North Atlantic DPS estimates the number of female nesting sea turtles to be approximately 167,424 individuals (NMFS and USFWS 2015a). Critical habitat has not been designated. The species was listed on the basis of significant population declines resulting from egg harvesting, incidental mortality in commercial fisheries, and nesting habitat loss.

5.1.2.1.2 Potential Occurrence Within the Action Area

Green sea turtles may be found as far north as Nova Scotia, and due to the warming of the Gulf of Maine may become more common in the Action Area compared to the last decade (Griffin et al. 2019; NMFS and USFWS 1991). However, green sea turtles would be considered rare in the Action Area. During the summer, the distribution of foraging subadults and adults can expand to include subtropical waters at higher latitudes. Juveniles and subadults are occasionally observed in Atlantic coastal waters as far north as Massachusetts (NMFS and USFWS 1991), including Cape Cod Bay (CETAP 1982), and therefore may occur in the Action Area during the summer months. Data from NOAA Fisheries sea turtle stranding and salvage network show two green sea turtle strandings in Maine and Massachusetts within the Gulf of Maine between January 1, 2018 and May 25, 2023, as a result of cold stunning and traditional stranding, respectively (NOAA Fisheries 2023x). No strandings occurred from 2013 through 2018 in the Gulf of Maine and there have not been reported nesting events in Maine or Massachusetts.

5.1.2.2 Kemp's Ridley Sea Turtle (Endangered)

The Kemp's ridley sea turtle is the smallest of sea turtle species. Adults can weigh between 70.5 and 108 pounds (32 and 49 kg) and reach up to 24 to 28 in (60 to 70 cm) in length (NMFS and USFWS 2007b). This species primarily inhabits the Gulf of Mexico, although large juveniles and adults travel along the U.S. Atlantic coast. Kemp's ridley inhabit coastal waters around Cape Canaveral, Florida up to Cape Hatteras, North Carolina during the winter (Waring et al. 2012).

In late fall, Atlantic juveniles/sub adults travel northward to forage in the coastal waters off Georgia through New England, then return southward for the winter (Stacy et al. 2013; NMFS 2022g). Nesting typically occurs from April to July and, unlike most other sea turtles, the species nests during the daytime. Most nesting areas are in the western Gulf of Mexico, primarily Tamaulipas and Veracruz, Mexico. Some nesting occurs periodically in Texas and few other U.S. states, occasionally extending up the Atlantic coast to North Carolina. Kemp's ridley sea turtles return to beaches, often in groups, to nest every 1 to 3 years and lay an average of two to three clutches per season (NMFS 2022g).

Juvenile and subadult Kemp's ridley sea turtles are known to travel as far north as Cape Cod Bay during summer foraging (NMFS et al. 2011). 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 2022g) and nearshore waters less than 120 ft deep (Shaver et al. 2005; Shaver and Rubio 2008), although it can also be found in deeper offshore waters. The species is coastally oriented, rarely venturing into waters deeper than 160 ft (50 m). It is primarily associated with mud sand-bottomed habitats, where primary prey species are found (NMFS and USFWS 2007b).

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 2007b). The species is also known to ingest natural and anthropogenic debris (Burke et al. 1993, 1994; Witzell and Schmid 2005).

Dow Piniak et al. (2012) concluded that sea turtle hearing is generally confined to lower frequency ranges below 1.6 kHz, with the greatest hearing sensitivity between 100 and 700 Hz, varying by species. Bartol and Ketten (2006) determined that Kemp's ridley hearing is more limited, ranging from 100 to 500 Hz, with greatest sensitivity between 100 and 200 Hz.

5.1.2.2.1 Current Status

The Kemp's ridley sea turtle was listed as endangered at the species level with the passage of the ESA in 1973 (35 *FR* 18319). All Kemp's ridley sea turtles belong to a single population. The species has experienced large population declines due to egg harvesting, loss of nesting habitat to coastal development and related human activity, bycatch in commercial fisheries, vessel strikes, and other anthropogenic and natural threats. The species began to recover in abundance and nesting productivity since conservation measures were initiated following listing. However, since 2009, the number of successful nests has declined markedly (NMFS and USFWS 2015b). Potential explanations for this trend, including the *Deepwater Horizon* oil spill in 2010, have proven inconclusive, suggesting that the decline in nesting may be due to a combination of natural and anthropogenic stressors (Caillouet et al. 2018). Current threats include incidental fisheries mortality, ingestion, and entanglement in marine debris, and vessel strikes (NMFS and USFWS 2015b).

The population was severely reduced by 1985 due to intensive egg collection and fishery bycatch, with a low of 702 nests counted from an estimated 250 nesting females on three primary nesting beaches in Mexico (Bevan et al. 2016; NMFS and USFWS 2015b). Recent estimates of the total population of

age 2 years and older is 248,307; however, recent models indicate a persistent reduction in survival or recruitment, or both, in the nesting population, suggesting that the population is not recovering to historical levels (NMFS and USFWS 2015b). A record high number of Kemp's sea turtle nests were recorded in 2017 (24,586 in Mexico and 353 in Texas). In 2019 there were 11,090 nests, a 37.61 percent decrease from 2018, and a 54.89 percent decrease from 2017. This decline is typical due to the reproduction biology of the species, as females nest approximately every 1 to 3 years (National Park Service 2023). Using the standard International Union for Conservation of Nature protocol for sea turtle assessments, the number of mature individuals was recently estimated at 22,341; the assessment concluded the current population trend is unknown (Wibbels and Bevan 2019). There is no designated critical habitat for Kemp's ridley sea turtles.

5.1.2.2 Potential Occurrence Within the Action Area

Kemp's ridley sea turtles may be found as far north as New England and due to the warming of the Gulf of Maine are increasingly likely to be found there, as they prefer warmer, nearshore coastal waters (Griffin et al. 2019; NMFS 2022c). Adult Kemp's ridley undergo a seasonal migration each year in the Atlantic, starting their journey to northern foraging grounds in spring, reaching New England by June, and traveling back to southern habitat in the fall, reaching the Mid-Atlantic by early November (Waring et al. 2012). Sea surface temperatures in the Gulf of Maine have warmed 97% faster (as of 2022) than the global ocean over the last decade, and as such, Kemp's ridley turtles are likely to occur more frequently as evidenced by higher numbers of cold stunned strandings reported from North Atlantic waters during late summer to late fall (Griffin et al. 2019).

Data from the NOAA Fisheries sea turtle stranding and salvage network show 10 strandings of Kemp's ridley sea turtles in Maine and the Gulf of Maine portion of Massachusetts between January 1, 2018 and May 25, 2023, largely the result of cold stunning reasons, with three traditional strandings (NMFS 2023g). No strandings occurred in Maine from 2013 through 2023. Nesting has not been reported in Maine or Massachusetts, therefore nesting events are expected to be rare in the Action Area.

5.1.2.3 Leatherback Sea Turtle (Endangered)

The leatherback sea turtle is primarily a pelagic species and is distributed in temperate and tropical waters worldwide, and are a species that regularly occur in colder waters where they can take advantage of high productivity regions with good foraging opportunities (Okuyama et al., 2021). The leatherback is the largest, deepest diving, most migratory, widest ranging, and most pelagic of the sea turtles (NMFS 2023h). Adults can reach up to 2,000 pounds (900 kg) and can be more than 6 ft (2 m) long (NMFS and USFWS 2013; NMFS 2023h). Adult leatherback sea turtles forage in temperate and subpolar regions in all oceans. Satellite tagged adults reveal migratory patterns in the North Atlantic that can include a circumnavigation of the North Atlantic Ocean basin, following ocean currents that make up the North Atlantic gyre, and preferentially targeting warm-water mesoscale ocean features such as eddies and rings as favored foraging habitats (Hays et al. 2006).

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 2020a). Unlike other predatory sea turtles with crushing jaws, the leatherback has evolved a sharp-edged jaw for consuming soft-bodied oceanic prey (NMFS 2023h) They are also known to feed on sea urchins, squid, crustaceans, tunicates, fish, blue-green algae, and floating seaweed (NMFS 2023h; USFWS 2023b).

James et al. (2006) studied leatherbacks' migratory behavior using satellite tags and observed that the timing of southerly migration ranges widely, extending from mid-August to mid-December, but with a distinct peak in October. 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 congregated to feed for extended periods. These findings are consistent with Kraus et al. (2016a), who recorded most of their leatherback sightings in the same area. The migratory corridors between breeding and northerly feeding areas appear to vary widely, with some individuals traveling through the OCS and others using the open ocean far from shore (James et al. 2006).

In a study tracking 135 leatherbacks fitted with satellite tracking tags, the species was identified to inhabit waters with sea surface temperatures ranging from 52°F to 89°F (11°C to 32°C) (Bailey et al. 2012). The leatherback sea turtle dives the deepest of all sea turtles to forage and is thought to be more tolerant of cooler oceanic temperatures than other sea turtles. The study also found that oceanographic features such as mesoscale eddies, convergence zones, and areas of upwelling attracted foraging leatherbacks because these features are often associated with aggregations of jellyfish.

Nesting beaches in the U.S. are concentrated in southeastern Florida from Brevard County south to Broward County (NMFS and USFWS 2013, 2020a; USFWS 2023b). Leatherbacks are a pelagically oriented species, but they are often observed in coastal waters along the U.S. continental shelf (NMFS and USFWS 2020a). Leatherbacks have been sighted along the entire coast of the eastern U.S. from the Gulf of Maine in the north and south to Puerto Rico, the Gulf of Mexico, and the U.S. Virgin Islands (NMFS and USFWS 2020a).

Dow Piniak et al. (2012) determined that the hearing range of leatherback sea turtles extends from approximately 50 to 1,200 Hz in water and 50 and 1,600 Hz in air, which is comparable to the general hearing range of turtles across species groups. Leatherbacks' greatest hearing sensitivity is between 100 and 400 Hz in water and 50 and 400 Hz in air.

5.1.2.3.1 Current Status

Leatherback sea turtles in the Action Area belong to the Northwest Atlantic population, which is one of seven leatherback populations globally. The species was listed as endangered under the ESA in 1970 (35 *FR* 8491), inclusive of all populations⁴. The breeding population (total number of adults) estimated in the North Atlantic is 34,000 to 94,000 (NMFS and USFWS 2013; TEWG 2007). NMFS and USFWS (2020a) concluded that the Northwest Atlantic population has a total index of nesting female abundance of 20,659 females with a decreasing nest trend at nesting beaches with the greatest known nesting female abundance.

Critical habitat for the Northwest Atlantic population is designated in the U.S. Virgin Islands and does not occur in the Action Area (NMFS and USFWS 2020a). Primary threats to the species include illegal harvesting of eggs, nesting habitat loss, and shoreline development. In-water threats include incidental catch and mortality from commercial fisheries, vessel strikes, anthropogenic noise, marine debris, oil pollution, and predation by native and exotic species (NMFS and USFWS 2020a).

5.1.2.3.2 Potential Occurrence Within the Action Area

In the Northwest Atlantic, leatherback sea turtles are widely dispersed. They are generally a highly mobile species, inhabiting open ocean environments as hatchlings and adults, although pelagic distribution of hatchling or juvenile leatherback sea turtles is largely unknown (NMFS and USFWS 1992). Adult leatherbacks are highly migratory and are believed to be the most pelagic of all sea turtles (NMFS and USFWS 1992) and would be expected to remain further offshore relative to other sea turtle

⁴ NMFS and USFWS have not designated DPSs for leatherback sea turtles because the species is listed as endangered throughout its global range (85 *FR* 48332); however, after reviewing the best available information, USFWS and NMFS (2020) identified seven leatherback populations that meet the discreteness and significance criteria of the DPS Policy, including the Northwest Atlantic population.

species, including waters beyond the shelf break. Tagged turtles have been documented migrating over large distances, greater than 7,000 km to foraging grounds located around the Atlantic (Palka et al. 2017, 2021). Leatherbacks have been spotted off Massachusetts in August, historically with no sightings from October through June (Musick and Limpus 1996). As with other species of sea turtles, with the temperatures of the Gulf of Maine increasing 97% faster compared to the rest of the ocean, they may be found more frequently in the area (Griffin et al. 2019).

Data from the NOAA Fisheries sea turtle stranding and salvage network show 28 strandings of leatherback sea turtles in the Gulf of Maine portions of Maine and Massachusetts between January 1, 2018 and May 25, 2023, with half resulting from incidental capture and half from traditional strandings (NMFS 2023g). There have been no recorded leatherback turtle nesting events in the Gulf of Maine.

5.1.2.4 Loggerhead Sea Turtle – Northwest Atlantic Ocean Distinct Population Segment (Threatened)

The loggerhead sea turtle is a globally distributed species found in temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans (NMFS and USFWS 2008). Loggerheads are the most common sea turtle species observed in offshore and nearshore waters along the U.S. East Coast, and virtually all of these individuals belong to the Northwest Atlantic Ocean DPS. Most of the loggerhead sea turtles nesting in the eastern U.S. occur from North Carolina through southwest Florida. Some nesting also occurs in southern Virginia and along the Gulf of Mexico coast westward into Texas (NMFS and USFWS 2008). Foraging loggerhead sea turtles range widely; they have been observed along the entire Atlantic coast of the U.S. as far north as the Gulf of Maine (Shoop and Kenney 1992) and northward into Canadian waters.

Female loggerhead sea turtles in the western north Atlantic nest from late April through early September. Individual females might nest several times within one season and usually nest at intervals of every 2 to 3 years. For their first 7 to 12 years of life, loggerhead sea turtles inhabit pelagic waters near the North Atlantic Gyre and are called pelagic immatures. When loggerhead sea turtles reach 40 to 60 cm straight-line carapace length, they begin recruiting to coastal inshore and nearshore waters of the OCS through the U.S. Atlantic and Gulf of Mexico and are referred to as benthic immatures. Benthic immature loggerheads have been found in waters from Cape Cod, Massachusetts, to southern Texas. Most recent estimates indicate that the benthic immature stage ranges from ages 14 to 32 years; they reach sexual maturity at approximately 20 to 38 years of age. Loggerhead sea turtles are largely present year-round in waters south of North Carolina, but will forage during summer and fall as far north as the Northeastern U.S. and Canada and migrate south as water temperatures drop. Prey species for omnivorous juveniles 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).

The loggerhead sea turtle has a powerful beak and crushing jaws specially adapted to feed on hard-bodied benthic invertebrates, including crustaceans and mollusks. Mollusks and crabs are primary food items for juvenile loggerheads (Burke et al. 1993). Although loggerheads are dietary specialists, the species demonstrates the ability to adjust its diet in response to changes in prey availability in different geographies (Plotkin et al. 1993; Ruckdeschel and Shoop 1988). Loggerheads in Chesapeake Bay, Virginia, primarily targeted horseshoe crabs (*Limulus polyphemus*) in the early to mid-1980s but subsequently shifted their diet to blue crabs in the late 1980s, and then to finfish from discarded fishery bycatch in the mid-1990s (Seney and Musick 2007).

Martin et al. (2012) and Lavender et al. (2014) used behavioral and auditory brainstem response methods to identify the hearing range of loggerhead sea turtles. Both teams identified a generalized hearing range from 100 Hz to 1.1 kHz, with greatest hearing sensitivity between 200 and 400 Hz.

5.1.2.4.1 Current Status

The Northwest Atlantic Ocean DPS of loggerhead sea turtle was listed as federally threatened under the ESA in 2011 (76 FR 58868). The regional abundance estimate in the Northwest Atlantic OCS in 2010 was approximately 588,000 adults and juveniles of sufficient size to be identified during aerial surveys (interquartile range of 382,000 to 817,000 [NEFSC and SEFSC 2011]). The three largest nesting subpopulations responsible for most of the production in the western North Atlantic (peninsular Florida, northern U.S., and Quintana Roo, Mexico) have all been declining since at least the late 1990s, thereby 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).

Critical habitat for Northwest Atlantic Ocean DPS of loggerhead sea turtles was designated in 2014 (79 FR 39755; 79 FR 51264). The four designated critical habitat units are nesting beaches in North Carolina, South Carolina, Georgia, Florida, Alabama, and Mississippi. No designated critical habitat occurs within the Action Area. Factors affecting the conservation and recovery of this species include beach development, related human activities that damage nesting habitat, and light pollution (NMFS and USFWS 2008, 2023). In-water threats include bycatch in commercial fisheries, vessel strikes, anthropogenic noise, marine debris, legal and illegal harvest, oil pollution, and predation by native and exotic species (NMFS and USFWS 2008, 2023).

5.1.2.4.2 Potential Occurrence Within the Action Area

Loggerhead sea turtles inhabit nearshore and offshore habitats, ranging, in the Northwest Atlantic, as far north as Newfoundland (NMFS 2022i). Post-hatchling loggerhead sea turtles have been found to inhabit areas that are characterized by linear accumulations of *Sargassum* spp. near nearshore, localized downwellings (NMFS and USFWS 2008). Winton et al. (2018) reported that loggerheads tagged within the Northwest Atlantic primarily restrict their summertime distribution to OCS waters and occasionally make excursions inshore to bays and estuaries. Core habitat includes sea surface temperatures from 59.0°F to 82.4°F and at depths between 8 and 92 m, and the highest probability of occurrence occurs in regions with sea surface temperatures from 63.9°F to 77.5°F and at depths between 26 and 74 m (Patel et al. 2021).

AMAPPS data from tagged loggerhead sea turtles and visual surveys indicate this species is observed throughout the U.S. Atlantic OCS in summer and fall, with a shift towards the southeastern U.S. in the winter and spring (Palka et al. 2021). Loggerheads are not often found in the Gulf of Maine, with one study (Warden 2011) of 70,000 otter trawl hauls over 15 years only finding one loggerhead. Data from the NOAA Fisheries sea turtle stranding and salvage network show nine strandings of loggerhead sea turtles in the Gulf of Maine between January 1, 2018 and May 25, 2023, largely the result of traditional stranding reasons (NMFS 2023g). These strandings are solely in Massachusetts, with no strandings in Maine from 2013 through 2023. There are no reported nesting events documented within the Gulf of Maine.

5.1.3 Marine Fish

5.1.3.1 Atlantic Sturgeon – All Distinct Population Segments (Endangered; Threatened)

The Atlantic sturgeon is a large, longlived, benthic fish found from Canada to Florida in river, estuarine, marine coastal, and OCS habitats. Individuals may be up to 13 ft (4 m) long, can reach up to 600 pounds, and live up to 60 years. Atlantic sturgeon are anadromous, meaning they are born in freshwater, migrate to sea, and then back to freshwater to spawn. Historically, Atlantic sturgeon were present in approximately 38 rivers in the U.S. from St. Croix, ME to the Saint Johns River, FL, of which 35 rivers

have been confirmed to have had a historical spawning population (ASSRT 2007). There are 22 rivers along the U.S. East Coast that currently host spawning Atlantic Sturgeon (NMFS 2023i). Spawning in rivers from Delaware to Canada occurs from spring to early summer; some rivers may support a second fall spawning population, though supporting data is limited (NMFS 2023i). Spawning occurs in the late summer and fall in rivers from Georgia to Chesapeake Bay (NMFS 2023i). Juveniles typically remain in their natal river for two to three years before migrating into coastal and ocean waters (NMFS 2023i). Subadults move out to estuarine and coastal waters in the fall; adults inhabit fully marine environments and migrate through deep water when not spawning (ASSRT 2007). While most individuals are most common near their natal river, extensive migrations within the marine environment have been documented for both adults and subadults, with some individuals traveling thousands of kilometers from their natal rivers (Kazyak et al. 2021). Their distribution and abundance vary by season as they are found in shallow coastal waters during the summer months and move to deeper waters in winter and early spring (Dunton et al. 2010).

Adult and subadult Atlantic sturgeon range widely across the Atlantic OCS, feeding primarily on benthic invertebrates and small fish on or near the seafloor. They appear to congregate in areas providing favorable foraging conditions (Stein et al. 2004a, b), exhibit dietary flexibility, and can adapt to changing prey availability (Guilbard et al. 2007; Johnson et al. 1997). During migrations along the eastern seaboard, Atlantic sturgeon are thought to travel north in the spring and south in the fall (Erickson et al. 2011). In a modeled study, Breece et al. (2018) discovered that spring migration takes place in shallower nearshore waters and, conversely, in deeper offshore waters for fall migration. Five genetically distinct DPSs make up the U.S. East Coast population; the Action Area falls within the NY Bight DPS and the Action Area additionally includes the Gulf of Maine DPS. However, given the species' proclivity to migrate, with extensive movements up and down the U.S. East Coast and into Canadian waters, Atlantic sturgeon encountered within the Action Area more broadly may originate from any of the five DPSs (Kazyak et al. 2021).

Male Atlantic sturgeon generally do not reach maturity until at least 12 years and females as late as 19 years (Dovel and Berggren 1983). Their interannual spawning period can range from 3 to 5 years, and adults inhabit marine waters either all year during non-spawning years or seasonally during spawning years (Bain 1997). Tagging data show that while at sea, adults intermix with populations from other rivers (ASSRT 2007). Despite their ability to range widely along the Atlantic coast, tagging and genetic studies indicate high site fidelity in natal rivers and very low gene flow among populations (Dovel and Berggren 1983; Grunwald et al. 2008; Savoy and Pacileo 2003).

Atlantic sturgeon are opportunistic predators that feed primarily on benthic invertebrates but will adjust their diet to exploit other types of prey resources when available. For example, Johnson et al. (1997) found that polychaetes composed approximately 86 percent of the diet of adult Atlantic sturgeon captured in the NY Bight. Isopods, amphipods, clams, and fish larvae composed the remainder of the diet, with the latter accounting for up to 3.6 percent of diet in some years. In contrast, Guilbard et al. (2007) observed that small fish accounted for up to 38 percent of subadult Atlantic sturgeon diet in the St. Lawrence River estuarine transition zone during summer, but less than 1 percent in fall. The remainder of the species' diet consisted primarily of amphipods, oligochaetes, chironomids, and nematodes, with the relative importance of each varying by season.

There is no available information on the hearing capabilities of Atlantic sturgeon specifically, although the hearing of other species of sturgeon have been studied. Meyer et al. (2010) and Lovell et al. (2005) studied the auditory system morphology and hearing ability of lake sturgeon (*Acipenser fulvescens*), a closely related species. The *Acipenseridae* (sturgeon family) have a well-developed inner ear that is independent of the swim bladder. The results of these studies indicate a generalized hearing range from 50 to approximately 700 Hz, with greatest sensitivity between 100 and 300 Hz. Popper (2005) summarized studies measuring the physiological responses of the ear of European sturgeon

(*Acipenser sturio*). The results of these studies suggest sturgeon are likely capable of detecting sounds from below 100 Hz to about 1 kHz. While sturgeon do have a swim bladder, it is not involved in hearing (Popper et al. 2014).

5.1.3.1.1 Current Status

All five DPSs of the Atlantic sturgeon are listed under the ESA; the Gulf of Maine DPS is listed as threatened whereas all others (i.e., New York Bight, Chesapeake Bay, Carolinas, and South Atlantic DPSs) are endangered (77 *FR* 5880, 77 *FR* 5914). The 2017 Atlantic sturgeon stock assessment reported that all DPSs remain depleted relative to historic distributions (ASMFC 2017). Though these DPSs represent distinct geographic populations along the U.S. Atlantic Coast, individuals from all DPSs migrate along the coast and are not easily distinguished visually from one another. Therefore, any Atlantic sturgeon encountered in the Action Area is considered endangered for the purpose of this analysis. In 2017, critical habitat was designated for all five DPSs of Atlantic sturgeon (82 *FR* 39160); these critical habitat designations are riverine. Atlantic sturgeon critical habitat is discussed in **Section 4.3.2**.

The species has suffered significant population declines across its range as a result of historical overfishing and degradation of freshwater and estuarine habitats by human development (ASSRT 2007). Bycatch mortality, water quality degradation, and dredging activities remain persistent threats. Some populations are impacted by unique stressors, such as habitat impediments and apparent ship strikes (ASSRT 2007). Historically, the Delaware River is thought to have supported the largest population of Atlantic sturgeon; recent studies estimate the current breeding population size is likely less than 250 adults, representing a greater than 99 percent decline since the late 1800s (USGS 2022). Indices from the New York Bight and Carolina DPSs indicated a greater than 50 percent chance of population increase since 1998, although the index from the Chesapeake Bay DPS only had a 36 percent chance of population increase across the same timeframe (ASMFC 2017).

Recently, Kahn et al. (2019) used a closed population mark-recapture model to estimate the population of Atlantic sturgeon from 2013 to 2018 in the York River, Virginia based on data collected from an acoustic tag deployed during sturgeon surveys within the York River. Population estimates (95% confidence interval) ranged from 73 to 222 individuals across their study. Since Atlantic sturgeon do not spawn every year, the trend in these estimates do not suggest a recovering or declining population, but a variability in the number of adults that return to spawn each year. Adult sex ratios from these data are estimated to approximately 0.51 (95% confidence intervals of 0.43-0.58) (Kahn et al. 2021).

5.1.3.1.2 Potential Occurrence Within the Action Area

Atlantic sturgeon, characterized as long-lived, late-maturing, estuarine-dependent, and anadromous, could be present throughout the Action Area depending on the various life history developmental stages. Females throughout the Atlantic tend to spawn every 2 to 5 years, with egg production between 400,000 to 2 million depending on maturity (NMFS 2023i). In non-spawning years, adults remain in marine waters year-round (Smith and Clugston 1997). Larvae develop into juveniles as they migrate downstream; juveniles remain in brackish waters until they grow to 30 to 35 in (75 to 90 cm) and move into nearshore coastal waters (Stein et al. 2004a; Erickson et al. 2011). Once suitably developed, Atlantic sturgeon move to marine waters with salinity greater than 30 ppt, marking the beginning of the subadult life stage. They typically occur within the 50-meter depth contour when in the marine environment (NMFS 2023i).

Similar to the shortnose sturgeon, the Gulf of Maine DPS of Atlantic sturgeon frequent coastal rivers including the Penobscot, Kennebec, Saco, and Merrimack Rivers near the Action Area (Wippelhauser et al. 2017; Fernandes et al. 2010). The Kennebec River system is the only known spawning population

within the DPS and sturgeon typically enter the area for spawning in April and May when temperature is on average less than 16.0 degrees C, departing after July, though with some males remaining until October (Wippelhauser et al. 2017). Atlantic sturgeon have similarly been found in the Penobscot River from late May through the end of October, spending the fall and winter in the marine environment or in deeper more saline parts of rivers (Fernandes et al. 2010; Collins and Smith 1997).

In a study of 681 individuals from 2006-2013, Wippelhauser et al. (2017) found that 63% entered rivers different from the one where they were tagged. 70% of the tagged sturgeon were found outside the rivers; in the Action Area this was offshore the Penobscot and Kennebec Rivers from September-February, and offshore the Scarborough Rivers and in Saco Bay from July-November (Wippelhauser et al. 2017). Both juvenile and adult Atlantic sturgeon found in the Saco River have also congregated near its mouth, likely due to the abundance of a preferred prey source, the American Sand Lance (Novak et al. 2017).

Their occurrence within the Research Lease Area is most likely as transients utilizing a migration corridor. Based on existing studies, Atlantic sturgeon would be more likely to occur near the coast rather than farther offshore in the Research Lease Area from fall to early spring. In the pelagic marine environment, Atlantic sturgeon range as far north as eastern Canada and occupy shelf waters up to a depth of 75 m (246 ft). Within the marine environment, encounters are considered unlikely as they are a predominantly benthic-dwelling species.

5.1.3.2 Atlantic Salmon – Gulf of Maine DPS (Endangered)

The geographic range of the Gulf of Maine DPS includes the Dennys River watershed to the Androscoggin River (74 FR 29343). Freshwater habitats in the Gulf of Maine provide spawning habitat and thermal refuge for adults; overwintering and rearing areas for eggs, fry, and parr; and migration corridors for smolts and adults (Bardonnnet and Bagliniere 2000). Spawning tends to happen from late October through November, with a preference to lay eggs in gravel areas with sufficient circulation (Fay et al. 2006). Eggs hatch in March or April, and the sac fry emerge from the gravel in mid-May, spending two to three years in the river before migrating to offshore areas (Fay et al. 2006). This migration is strongly affected by oceanic features such as gyres, currents, and water temperature (Meister 1984; Lacroix and Knox 2005; Lacroix et al. 2012).

Atlantic salmon in the Gulf of Maine are known to migrate long distances in the open ocean to feeding areas in the Davis Strait between Labrador and Greenland, approximately 2,485 mi (4,000 km) from their natal rivers (Danie et al. 1984; Meister 1984). To make these long migrations, salmon smolts require a steady food source, as they are initially energy deficient (Lacroix and Knox 2005; Jonsson and Jonsson 2003). Atlantic salmon consume a variety of food sources, with juveniles eating a variety of invertebrates and plankton, and adults preferring capelin fish when in the open ocean, though they are also opportunistic predators (NMFS 2023j; Dixon et al. 2017). In recent years, notably from estimates from 1968-2008, capelin size has decreased by 33.7%, which has likely impacted foraging of the salmon (Renkawitz et al. 2015). Lacroix and Knox (2005) found that post-smolts, the life stage when salmon adapt from fresh to saltwater but are not yet full grown, consumed crustaceans including the amphipod hyperiidae, krill, and larval fish such as sand lances. These prey options extend across the open ocean, with the Gulf of Maine providing more krill than larval fish in their diet (Lacroix and Knox 2005). Approximately 90 percent of Atlantic salmon from the Gulf of Maine return after spending two winters at sea; usually less than 10 percent return after spending one winter at sea and approximately 1 percent of returning salmon are repeat spawners or have spent three winters at sea (Baum 1997).

Atlantic salmon appear not to have sensitive hearing, likely because their swimbladder is not connected to their hearing (Harding et al. 2016; Hawkins and Johnstone 1978). Atlantic salmon may hear at higher frequencies of 400 to 800 Hz, though they may be sensitive to frequencies greater than 100 (Hawkins and Johnstone 1978) or 200 Hz (Harding et al. 2016)

5.1.3.2.1 Current Status

The Gulf of Maine DPS of Atlantic salmon is the only DPS listed under the ESA that may occur within the Action Area. They were originally listed as endangered in December 2000 (65 *FR* 69459), and the listing was updated in June 2009 to expand the range of the Gulf of Maine DPS listed under the ESA (74 *FR* 29343).

Though water quality improvements led to an increase in the total population to approximately 5,000 individuals in 1985, due to the continued existence of dams and low survival at sea, the average number of adults that return to Gulf of Maine rivers is currently 1,200 (NMFS 2023j; NMFS and USFWS 2019).

Threats to Atlantic salmon are primarily a result of dams and their effects on migration paths; additional threats include a lack of habitat complexity in certain freshwater areas, poor or insufficient water quantity, disease, and predation (NOAA and USFWS 2019; Fay et al. 2006). The Gulf of Maine DPS is also vulnerable to changing conditions resulting from climate change, particularly at the post-smolt stage. Changes in spring winds have left post-smolts more susceptible to predation in their migration corridors, pushing them closer to inshore waters where they encounter new predators and for a longer amount of time (Friedland et al. 2012).

Critical habitat is designated in the State of Maine for a total of 19,571 km of river, stream, and estuary habitat, as well as 799 sq. km of lake (74 *FR* 29299). Atlantic salmon critical habitat is adjacent to the Action Area but does not overlap with it (**Section 4.3.1**).

5.1.3.2.2 Potential Occurrence Within the Action Area

Atlantic salmon utilize the Gulf of Maine as juveniles to transit hundreds of kilometers to their offshore foraging areas near Greenland before crossing the Gulf of Maine again after two years to return to their natal river for spawning (Danie et al. 1984; Meister 1984; Lacroix et al. 2012). The adults have historically entered rivers from May to Mid-July for spawning, and afterwards return to sea and may return to the river in future years to lay more eggs (Meister 1958; Baum 1997; NMFS 2023j).

After the eggs hatch, the juveniles, referred to as parr, spend two to three years in freshwater (NMFS 2023j), and then emerge from the rivers, utilizing specific migration corridors when transiting to the open sea, with studies showing that they prefer areas with high tidal forces (Kocik et al. 2009). They spend about 3 to 10 days traveling down a given river, within a 25-day period for juveniles from all rivers, moving from natal rivers to the Gulf of Maine, although a high mortality rate of 53-64% is experienced when entering nearshore waters, potentially due to the transition to saltwater (Kocik et al. 2009). This transition to the marine environment occurs mainly from May through June, though it may extend into July. Individuals then travel eastward across the Gulf of Maine and then northeast along the coast of Nova Scotia, Canada (Meister 1984; Lacroix et al. 2012).

This eastward migration may cross directly through the Action Area more broadly. Individuals may occur in the upper water column near the surface; these post-smolts also are most commonly detected in the upper 5 m during their migration offshore, though they do utilize entire whole water column (Renkawitz et al. 2012). Interestingly, post-smolts that swim in the upper water column have higher survival rates than those that swim deeper (Renkawitz et al. 2012).

5.2 Critical Habitat LAA or Critical Habitat Considered for Further Analysis

5.2.1 North Atlantic Right Whale Critical Habitat

In 1994, NMFS designated critical habitat for the Northern right whale population in the North Atlantic Ocean (59 *FR* 28805). This critical habitat designation included portions of Cape Cod Bay, Stellwagen Bank, the Great South Channel, and waters adjacent to the coasts of South Carolina, Georgia, and the east coast of Florida. These areas were determined to provide critical feeding, nursery, and calving habitat for the North Atlantic population of northern right whales.

In 2016, NMFS revised designated critical habitat for the North Atlantic right whale with two new expanded areas. The areas designated as critical habitat contains approximately 29,763 nmi² (102,084.2 km²) of marine habitat in the Gulf of Maine and Georges Bank region (Unit 1) (**Figure 5-5**) and off the Southeast U.S. coast (Unit 2) (**Figure 5-6**). Unit 1 is the only critical habitat that overlaps with the Action Area. The physical and biological features (PBFs) essential to the conservation of the North Atlantic right whale, which provide foraging area functions in Unit 1 are a combination of: (1) the physical oceanographic conditions and structures of the Gulf of Maine and Georges Bank region that combine to distribute and aggregate *Calanus finmarchicus* for North Atlantic right whale foraging, namely prevailing currents and circulation patterns, bathymetric features (basins, banks, and channels), oceanic fronts, density gradients, and temperature regimes; (2) low flow velocities in Jordan, Wilkinson, and Georges Basins that allow diapausing *C. finmarchicus* to aggregate passively below the convective layer so that the copepods are retained in the basins; (3) late stage *C. finmarchicus* in dense aggregations in the Gulf of Maine and Georges Bank region; and (4) Diapausing *C. finmarchicus* in aggregations in the Gulf of Maine and Georges Bank region.

The PBFs essential to the conservation of North Atlantic right whale calving habitat that are essential to the conservation of the North Atlantic right whale, which provide calving area functions in Unit 2 are: (1) calm sea surface conditions of Force 4 or less on the Beaufort Wind Scale; (2) sea surface temperatures from a minimum of seven degrees Celsius, and never more than 17 degrees Celsius; and (3) water depths of 6 to 28 m (19.7 to 91.9 ft) where these features simultaneously co-occur over contiguous areas of at least 231 nmi² (792.3 km²) of ocean waters during the months of November through April. When these features are available, they are selected by North Atlantic right whale cows and calves in dynamic combinations that are suitable for calving nursing, and rearing, and which vary, within the ranges specified, depending on factors such as weather and age of the calves (81 *FR* 4838).



Figure 5-5. Map identifying designated critical habitat in the northeastern foraging area Unit 1 for the North Atlantic right whale

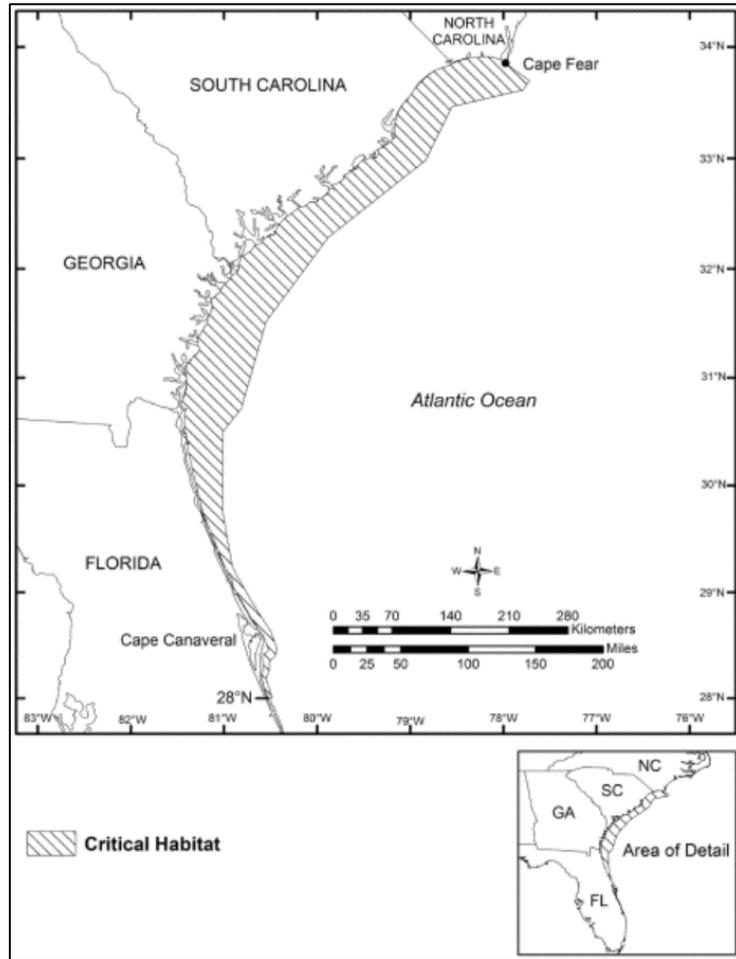


Figure 5-6. Map identifying designated critical habitat in the southeastern calving area Unit 2 for the North Atlantic right whale

Unit 2 is outside of the Action Area whereas Unit 1 encompasses the entirety of the Action Area. No effects of the Proposed Action were identified that would affect the PBFs essential to the conservation of the NARW or the ability of NARWs to select an area with these features. The presence of a small number of vessels is not expected to affect the selection of these critically important features by NARWs it. As a precaution, and required by federal regulations, all vessels must maintain 1,640 ft (500 m) or greater from any sighted NARW. Compliance with this regulation aids in ensuring no adverse effects on the ability of whales to select an area with the co-occurrence of these features.

6 Effects of the Action on ESA-listed Species

Effects of the action are all consequences to listed species or critical habitat that are caused by the Proposed Action, including the consequences of other activities that are caused by the Proposed Action. A consequence is caused by the Proposed Action if the effect would not occur but for the Proposed Action and the effect is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (50 CFR 402.02).

In this section of the BA, we assess the effects of the action on listed species and critical habitat that are likely to be adversely affected. The quantitative and qualitative analyses in this section are based upon the best available commercial and scientific data on species biology and the effects of the action. Data are limited, so we are often forced to make assumptions to overcome the limits in our knowledge. Sometimes, the best available information may include a range of values for a particular aspect under consideration, or different analytical approaches may be applied to the same data set. In those cases, the uncertainty is resolved in favor of the species. This approach provides the “benefit of the doubt” to threatened and endangered species.

Effects of the Proposed Action are evaluated for the potential to result in harm to listed species. If a Project-related activity may affect a listed species, the exposure level and duration of effects are evaluated further for the potential for those effects to harass or injure listed species. The following sections present the potential project-related effects on listed species of marine mammals, sea turtles, and fish from site assessment and site characterization activities with the application monitoring and mitigation measures as described in **Section 3.3**. This effects discussion is organized by stressor responsible for impacts to each ESA-animal group (e.g., marine mammals, sea turtles, and marine fish).

6.1 Description of Stressors

Stressors that may affect ESA-listed species and critical habitat analyzed in this assessment that were not already discounted in **Sections 4.2 and 4.3** are presented in **Table 6-1**.

Table 6-1. Stressors that could affect listed species and critical habitat

Stressor ^a	Description	Sources and/or Activities	Listed Species ^b Exposed to the Stressor
Underwater Noise	Refers to noise from various sources and commonly associated with geophysical and geotechnical surveys, and vessel traffic.	<ul style="list-style-type: none"> • Vessels • Geophysical and geotechnical surveys 	Fin whale (<i>Balaenoptera physalus</i>) NARW (<i>Eubalaena glacialis</i>) Sei whale (<i>Balaenoptera borealis</i>) Sperm whale (<i>Physeter macrocephalus</i>) Green sea turtle (<i>Chelonia mydas</i>) Kemp's ridley sea turtle (<i>Lepidochelys kempii</i>) Leatherback sea turtle (<i>Dermochelys coriacea</i>) Loggerhead sea turtle (<i>Caretta caretta</i>) Atlantic sturgeon (<i>Acipenser oxyrinchus oxyrinchus</i>) Atlantic salmon (<i>Salmo salar</i>) NARW critical habitat
Vessel Strike Risk	Refers to marine vessel traffic, including vessel strikes of marine mammals, sea turtles, and marine fish.	<ul style="list-style-type: none"> • Vessels 	Fin whale NARW Sei whale Sperm whale Green sea turtle Kemp's ridley sea turtle Leatherback sea turtle Loggerhead sea turtle Atlantic sturgeon

Stressor ^a	Description	Sources and/or Activities	Listed Species ^b Exposed to the Stressor
Habitat Disturbance	Refers to effects from turbidity resulting from benthic disturbances; temporary seafloor disturbances; and the presence of structures.	<ul style="list-style-type: none"> • Placement and removal of the FLiDAR buoy • Geotechnical surveys, • Benthic surveys • Vessel anchoring. 	Fin whale NARW Sei whale Sperm whale Green sea turtle Kemp's ridley sea turtle Loggerhead sea turtle Atlantic sturgeon Atlantic salmon NARW critical habitat
Entanglement and capture	Survey activities under the Proposed Action that pose an entanglement and capture risk to ESA-listed species due to the use of in-water fisheries sampling gear. This includes bottom trawl surveys for marine fish and invertebrates, plankton and larval lobster surveys, lobster trawl surveys, and gillnet surveys.	<ul style="list-style-type: none"> • FLiDAR buoy and PAM mooring • Fisheries surveys 	Fin whale NARW Sei whale Sperm whale Green sea turtle Kemp's ridley sea turtle Leatherback sea turtle Loggerhead sea turtle Atlantic sturgeon Atlantic salmon NARW critical habitat
Air emissions	Refers to the release of gaseous or particulate pollutants into the atmospheres. Can occur on- and offshore.	<ul style="list-style-type: none"> • Internal combustion engines within mobile sources such as vessels, vehicles, or aircraft 	Fin whale NARW Sei whale Sperm whale Green sea turtle Kemp's ridley sea turtle Leatherback sea turtle Loggerhead sea turtle

Stressor ^a	Description	Sources and/or Activities	Listed Species ^b Exposed to the Stressor
Lighting	Refers to the presence of light above the water onshore and offshore as well as underwater	<ul style="list-style-type: none"> • Vessels or FLiDAR Buoy 	Fin whale NARW Sei whale Sperm whale Green sea turtle Kemp's ridley sea turtle Leatherback sea turtle Loggerhead sea turtle
Non-Routine Events	Effects associated with non-routine events, such as storms, allisions and collisions, spills, and recovery of lost equipment.	<ul style="list-style-type: none"> • Vessels • Fisheries Surveys • Benthic surveys 	Fin whale NARW Sei whale Sperm whale Green sea turtle Kemp's ridley sea turtle Loggerhead sea turtle Atlantic sturgeon Atlantic salmon NARW critical habitat

BA = Biological Assessment; ESA = Endangered Species Act; HRG = high-resolution geophysical; NARW = North Atlantic right whale; USCG = U.S. Coast Guard; USEPA = U.S. Environmental Protection Agency

^a The following stressors have been discounted from the assessment in the BA for the ESA-listed resources analyzed because they are not expected to have any discernable effects on these species: land disturbance, in-air noise.

^b All critical habitat within the Action Area has been excluded from further analysis (**Section 5.2**) and, therefore, is not analyzed in **Section 6**.

6.2 Determination of Effects

The term “consequences,” was introduced to the ESA to replace “direct” and “indirect” effects in 2019. Consequences are a result or effect of an action on ESA species. NMFS uses two criteria to identify the ESA-listed species and designated critical habitat that are **not likely to be adversely affected** by the Proposed Action.

The first criterion is exposure, or some reasonable expectation of a co-occurrence, between one or more potential stressors associated with the proposed activities and ESA-listed species or designated critical habitat. If NMFS concludes that an ESA-listed species or designated critical habitat is not likely to be exposed to the proposed activities, they must also conclude that the species or designated critical habitat is **not likely to be adversely affected** by those activities.

The second criterion is the probability of a response given exposure. An ESA-listed species or designated critical habitat that co-occurs with a stressor of the action but is not likely to respond to the stressor is also **not likely to be adversely affected** by the Proposed Action.

Section 7(a)(2) of the ESA requires federal agencies, in consultation with NMFS, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species; or adversely modify or destroy their designated critical habitat.

“Jeopardize the continued existence of” means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of an ESA-listed species in the wild by reducing the reproduction, numbers, or distribution of that species” (50 CFR §402.02).

“Destruction or adverse modification” means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of an ESA-listed species as a whole (50 CFR §402.02).

Based on an analysis of potential consequences, we provide a determination for each species and designated critical habitat. One of the following three determinations, as defined by the ESA, has been applied for listed species and critical habitat that have potential to be affected by the project: No effect; may affect, not likely to adversely affect; may affect, likely to adversely affect.

The probability of an effect on a species or designated critical habitat is a function of exposure intensity and susceptibility of a species to a stressor’s effects (i.e., probability of response).

No effect – This determination indicates that the Project would have no impacts, positive or negative, on species or designated critical habitat. Generally, this means that the species or critical habitat would not be exposed to the Project and its environmental consequences.

A **may affect, not likely to adversely affect** determination would be given if the project’s effects are wholly beneficial, insignificant, or discountable.

Beneficial effects have an immediate positive effect without any adverse effects to the species or habitat.

Insignificant effects relate to the size or severity of the impact and include those effects that are undetectable, not measurable, or so minor that they cannot be meaningfully evaluated. *Insignificant* is the appropriate effect conclusion when plausible effects are going to happen but will not rise to the level of constituting an adverse effect.

*Discountable*⁵ effects are those that are extremely unlikely to occur. For an effect to be discountable, there must be a plausible adverse effect (i.e., a credible effect that could result from the action and that would be an adverse effect if it did impact a listed species), but it is extremely unlikely to occur (USFWS and NMFS 1998).

A may affect, likely to adversely affect determination occurs when the Project may result in any adverse effect on a species or its designated critical habitat. In the event that the project may have beneficial effects on listed species or critical habitat, but is also likely to cause some adverse effects, then the Project **may affect, likely to adversely affect**, the listed species.

This BA analyzes the potential effects that may result from site assessment and site characterization activities considered part of the Proposed Action described in **Section 3**. The results of this assessment determined the following stressors may affect but are not likely to adversely affect any of the ESA-listed species considered in this BA. An overview of these stressors is provided in **Table 6-2** followed by a detailed analysis of each stressor provided in **Sections 6.3** through **6.10**.

⁵ When the terms “discountable” or “discountable effects” appear in this document, they refer to potential effects that are found to support a “not likely to adversely affect” conclusion because they are extremely unlikely to occur. The use of these terms should not be interpreted as having any meaning inconsistent with the ESA regulatory definition of “effects of the action.”

Table 6-2. Stressors that are not likely to adversely affect ESA-listed species, critical habitat

Stressor		Marine Mammals				Sea Turtles				Marine Fish		Critical Habitat
		Fin Whale	North Atlantic Right Whale	Sei Whale	Sperm Whale	Green Sea Turtle (North Atlantic DPS)	Leatherback Sea Turtle	Loggerhead Sea Turtle (Northwest Atlantic DPS)	Kemp's Ridley Sea Turtle	Atlantic Sturgeon	Atlantic Salmon	NARW Unit 1
Underwater Noise	HRG Survey Noise	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA
	Geotechnical Sampling Noise	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA
	Vessel Noise	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA
Habitat Disturbance	Temporary Seafloor Disturbances	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NE
	Turbidity	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA
	Behavioral Changes due to the Presence of Structures	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NE
	Entanglement	NLAA	NLAA	NLAA	NLAA	LAA	LAA	LAA	LAA	LAA	LAA	NLAA
	Air Emissions	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NE
	Lighting	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NE

Stressor		Marine Mammals				Sea Turtles				Marine Fish		Critical Habitat
		Fin Whale	North Atlantic Right Whale	Sei Whale	Sperm Whale	Green Sea Turtle (North Atlantic DPS)	Leatherback Sea Turtle	Loggerhead Sea Turtle (Northwest Atlantic DPS)	Kemp's Ridley Sea Turtle	Atlantic Sturgeon	Atlantic Salmon	NARW Unit 1
Non-Routine Events	Storms	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
	Allisions and Collisions	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
	Spills	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA
	Recovery of Lost Survey Equipment	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NE
Overall Effects Determination		NLAA	NLAA	NLAA	NLAA	LAA	LAA	LAA	LAA	LAA	LAA	NLAA

DPS = distinct population segment; HRG = high-resolution geophysical; LAA = likely to adversely affect; NARW = North Atlantic right whale; NE = no effect; NLAA = not likely to adversely affect

6.3 Underwater Noise

BOEM recognizes that ESA-listed species can be exposed to underwater noise resulting from activities under the Proposed Action including vessel noise, HRG surveys, and geotechnical surveys. While the geophysical reconnaissance surveys will also use geophysical survey equipment, the proposed equipment all have operating frequencies (greater than 180 kHz) above relevant marine mammal, sea turtle, and ESA-listed fish primary hearing sensitivities or produce very narrow beamwidths so they are unlikely to be detectable beyond a few meters from the sources for most species so no notable effects are expected. The extent and severity of auditory and non-auditory effects from the Proposed Action generated underwater noise is dependent on the timing of activities relative to species occurrence, the type of noise impact, and species-specific sensitivity.

Underwater sounds in the marine environment originate from a variety of sources including non-biological sources such as wind and waves, and the movements or vocalizations of marine life (Hildebrand 2009). Human activities can also introduce sound into the marine environment through activities like oil and gas exploration, construction, military sonars, and vessel traffic (Hildebrand 2009). The acoustic habitat or “soundscape” of a given ecosystem comprises all such sounds—biological, non-biological, and anthropogenic (Pijanowski et al. 2011). Soundscapes are highly variable across space, time, and water depth, among other factors, due to the properties of sound transmission and the types of sound sources present in each area. A soundscape is sometimes called the “acoustic habitat,” as it is a vital attribute of a given area where an animal may live (i.e., habitat) (Hatch et al. 2016).

Sounds are created by the vibration of an object within its medium, in this case water. When the object’s vibration is coupled to the medium, that vibration travels as a propagating wave away from the sound source. As this wave moves through the water, the particles undergo tiny back-and-forth movements (i.e., particle motion), when the motion results in more particles in one location, that location has relatively higher pressure. Particles are then accelerated out of the higher pressure region causing particle motion. The particles themselves do not travel with the wave, instead they oscillate in roughly the same location, transferring their energy to surrounding particles. Acoustic pressure is a non-directional (scalar) quantity, whereas particle motion is an inherently directional quantity (a vector). The total energy of the sound wave includes the potential energy associated with the sound pressure as well as the kinetic energy from particle motion.

Propagation of underwater sound can be described through a source-path-receiver model. An underwater acoustic source emits sound energy that radiates outward and travels through the water and the seafloor as mechanical waves. The sound level decreases with increasing distance from the acoustic source as the sound pressure waves spread out under the influence of the surrounding receiving environment. The amount by which the sound levels decrease between a source and a receiver is called transmission loss. The amount of transmission loss that occurs depends on the source-receiver separation, the frequency of the sound, the properties of the water column, and the properties of the seafloor. Underwater sound levels are expressed in decibels (dB), which is a logarithmic ratio relative to a fixed reference pressure of 1 micropascal (μPa) (equal to 10^{-6} pascals [Pa] or 10^{-11} bar).

The efficiency of underwater sound propagation allows marine animals to use underwater sound as a method of communication, navigation, prey detection, and predator avoidance (Richardson et al. 1995; Southall et al. 2007; Dow Piniak et al. 2012; Popper and Hawkins 2018, 2019). Anthropogenic (i.e., human-introduced) noise has gained recognition as a potential stressor for marine life because of their reliance on underwater hearing for maintenance of these critical biological functions (Richardson et al. 1995; Ketten 1998; Dow Piniak et al. 2012; Popper and Hawkins 2018, 2019). Underwater noise generated by human activities can often be detected by marine animals many kilometers from the source.

With increasing distance from a noise source, potential acoustic impacts can range from physiological injury to permanent or temporary hearing loss, behavioral changes, and acoustic masking (i.e., communication interference). All the above impacts could induce stress on marine animals in their receiving environment (OSPAR Commission 2009; Erbe 2013).

Anthropogenic noise sources are classified as either impulsive or non-impulsive and continuous or intermittent based on their acoustic characteristics (NMFS 2018, 2023). Specifically, when it comes to potential damage to marine animal hearing, sounds are classified as either impulsive or non-impulsive, and when considering the potential to affect behavior or acoustic masking, sounds are classified as either continuous or intermittent.

Impulsive noises are characterized as having (Finneran 2016):

- broadband frequency content;
- fast rise-times and rapid decay times;
- short durations (i.e., less than 1 s); and
- high peak sound pressures.

Whereas the characteristics of non-impulsive sound sources are less clear but may be:

- variable in spectral composition, i.e., broadband, narrowband, or tonal;
- longer rise-time/decay times, and total durations compared to an impulsive sound; and
- continuous (e.g., vessel engine radiated noise), or intermittent (e.g., echosounder pulses).

Impulsive sounds are more likely to induce auditory function effects, including temporary threshold shift (TTS) and permanent threshold shift (PTS), than non-impulsive sounds with the same energy. This binary, at-the-source classification of sound types, therefore, provides a conservative framework upon which to predict potential adverse hearing impacts to marine life.

For behavioral effects of anthropogenic sound on marine mammals, NMFS classifies sound sources as either intermittent or continuous (NMFS 2023k). Continuous sounds, such as vessel noise continuously produce noise above ambient sound levels, for a given period of time, during which exposures to the noise may induce a behavioral reaction. An intermittent sound typically consists of pulses of sound on a regular on-off pattern, also called the duty-cycle. Examples of intermittent sounds are those from scientific echosounders, sub-bottom profilers, and geotechnical coring. It is important to recognize that these delineations are not always practical in application, as a continuous yet moving sound source (such as a vessel passing over a fixed receiver) could be considered intermittent from the perspective of the receiver.

Sensitivity to PTS, TTS, and behavioral disturbance will depend upon the frequency of the source and the hearing sensitivity of the receiver to those frequencies. The importance of underwater noise for a given animal can be scaled by frequency weighting relative to an animal's sensitivity to those frequencies (Nedwell and Turnpenny 1998; Nedwell et al. 2007). Acoustic thresholds used for the purpose of predicting the extent of potential noise impacts on marine mammal, sea turtle, and fish hearing and subsequent management of these impacts account for the duration of exposure, incorporation of more recent hearing and TTS data, and the differences in hearing acuity in various marine species or life stages (Finneran 2016; NMFS 2023k).

Auditory thresholds from underwater noise are expressed using three common metrics: root-mean-square sound pressure level (SPL) and peak sound pressure level (L_{pk}), both measured in dB re 1 μ Pa, and sound

exposure level (SEL), a measure of energy in dB re $1 \mu\text{Pa}^2 \text{ s}$. L_{pk} is an instantaneous value, whereas SEL is the total noise energy over a given time period or event. As such, the SEL accumulated over 24 hours, ($\text{SEL}_{24\text{h}}$) is appropriate when assessing effects to marine mammals from cumulative exposure to multiple pulses or durations of exposure. SPL is a root mean square average over a period of time and is equal to the SEL divided (linearly) by the time period of exposure. Therefore, if the time period is 1 second, the SEL and the SPL are equal.

The auditory and non-auditory thresholds used in this BA are given below for each species group. The extent and severity of auditory and non-auditory effects from project generated underwater noise is dependent on the timing of activities relative to species occurrence, the type of noise impact, and species-specific sensitivity.

6.3.1 Underwater Noise and Marine Mammals

Marine mammals rely heavily on acoustic cues for extracting information from their environment. Sound travels faster and farther in water (~1500 m/s) than it does in air (~350 m/s), making this a reliable mode of information transfer across large distances and in environments where visual cues are limited. Acoustic communication is used in a variety of contexts, such as attracting mates, communicating to young, or conveying other relevant information (Bradbury and Vehrencamp 1998). Marine mammals can also glean information about their environment by listening to acoustic cues, like ambient sounds from a reef, the sound of an approaching storm, or the call from a nearby predator. Finally, toothed whales produce and listen to echolocation clicks to locate food and to navigate (Madsen and Surlykke 2013).

Like terrestrial mammals, the auditory anatomy of marine mammals generally includes the inner, middle, and outer ear (Ketten 1994). Not all marine mammals have an outer ear, but if it is present, it funnels sound into the auditory pathway, capturing the sound. The middle ear acts as a transformer, filtering and amplifying the sound. The inner ear is where auditory reception takes place. The key structure in the inner ear responsible for auditory perception is the cochlea, a spiral-shaped structure containing the basilar membrane, which is lined with auditory hair cells. Specific areas of the basilar membrane vibrate in response to the frequency content of the acoustic stimulus, causing hair cells mapped to specific frequencies to be differentially stimulated and send signals to the brain (Ketten 1994). While the cochlea and basilar membrane are well conserved structures across all mammalian taxa, there are some key differences in the auditory anatomy of terrestrial versus marine mammals that require explanation. Marine mammals have the unique need to hear in aqueous environments. Amphibious marine mammals (including seals, sea otters, and sea lions) have evolved to hear in both air and under water, and all except phocid pinnipeds have external ear appendages. Cetaceans do not have external ears, do not have air-filled external canals, and the bony portions of the ear are much denser than those of terrestrial mammals (Ketten 1994).

All marine mammals have binaural hearing and can extract directional information from sound. But the pathway that sound takes into the inner ear is not well understood for all cetaceans and may not be the same for all species. For example, in baleen whales (i.e., mysticetes), bone conduction through the lower jaw may play a role in hearing (Cranford and Krysl 2015), while odontocetes have a fat-filled portion of the lower jaw which is thought to funnel sound towards the ear (Mooney et al. 2012). Hearing tests have been conducted on several species of odontocetes, but there has yet to be a hearing test on a baleen whale, so most of our understanding comes from examining the ears from deceased whales (Erbe et al. 2016; Houser et al. 2017).

Many marine mammal species produce sounds through vibrations in their larynx (Frankel 2009). In baleen whales, for example, air in the lungs and laryngeal sac expands and contracts, producing vibrations and sounds within the larynx (Frankel 2009). Baleen whales produce low frequency sounds that can be used to communicate with other animals over great distances (Clark and Gagnon 2002). Differences in

sound production among marine mammal species vary, in part, with their use of the marine acoustic environment. Toothed whales hunt for their prey using high-frequency echolocation signals. To produce these signals they have a specialized structure called the “melon” in the top of their head that is used for sound production. When air passes through the phonic lips, a vibration is produced, and the melon helps transmit the vibration from the phonic lips to the environment as a directed beam of sound (Frankel 2009). It is generally believed that if an animal produces and uses a sound at a certain frequency, its hearing sensitivity will at least overlap those particular frequencies. An animal’s hearing range is likely much broader than this, as they rely heavily on acoustic information, beyond the signals they produce themselves, to understand their environment.

The sections below provide an overview of the available information on marine mammal hearing, the thresholds applied, information available in the literature regarding source levels for sound sources assessed in this BA, and the impact consequences for each potential underwater noise generating activity for the Proposed Action.

For sound sources or for species where no Project specific modeling was completed, information available in the literature regarding source levels was used to develop the effects analysis.

6.3.1.1 Auditory Criteria for Injury and Behavioral Disturbance to Marine Mammals

Assessment of the potential effects of underwater noise on marine mammals requires acoustic thresholds against which received sound levels can be compared. For marine mammals, established acoustic criteria for hearing injury and behavioral disturbance recognized by NMFS have recently been updated in terms of auditory injury thresholds (NMFS 2023k). The revised auditory injury thresholds apply dual criteria based on Lpk and SEL_{24hr} and are based on updated frequency weighting functions for five marine mammal hearing groups described by NMFS (2023k), Southall et al. (2007) and Finneran and Jenkins (2012). However, the species considered in the analysis in this BA only belong to two hearing groups, as summarized in **Table 6-3**.

Table 6-3. Marine mammal hearing groups for Endangered Species Act (ESA)-listed marine mammal species

Hearing Groups	Taxonomic Group	Generalized Hearing Range ¹
Low-frequency cetaceans (LFC)	Baleen whales (e.g., NARW, fin whale)	7 Hz to 35 kHz
Mid-frequency cetaceans (MFC)	Sperm whale	150 Hz to 160 kHz

Source: Southall et al. (2007) Finneran and Jenkins (2012), and NMFS (2023k)

Hz = hertz; kHz = kilohertz; NARW = North Atlantic right whale

¹ The generalized hearing range is for all species within a group. Individual hearing may vary. Generalized hearing range based on ~65 dB threshold from normalized composite audiogram, with the exception for lower limits for LFC (Southall et al. 2007).

Behavioral disturbance thresholds for marine mammals are based on SPL of 160 dB re 1 μPa for impulsive or non-impulsive, intermittent sounds and 120 dB re 1 μPa for non-impulsive, continuous sounds for all marine mammal species (NMFS 2023k). Although these behavioral disturbance thresholds remain current (in the sense that they have not been formally superseded by newer directives), they are not frequency weighted to account for different hearing abilities by the five marine mammal hearing groups.

The potential for underwater noise exposures to result in adverse impacts on a marine mammal depends on the received sound level, the frequency content of the sound relative to the hearing ability of the animal, the duration, and the level of natural background noise. Potential effects range from subtle changes in behavior at low received levels to strong disturbance effects or potential injury at high received levels.

Sound reaching the receiver at sufficient loudness and for an ample duration can result in a loss of hearing sensitivity in marine animals termed a noise-induced threshold shift. This may consist of TTS or PTS. TTS is a relatively short-term, reversible loss of hearing following exposure (Southall et al. 2007, 2019), often resulting from cellular fatigue and metabolic changes (Saunders et al. 1985; Yost 2000). While experiencing TTS, the hearing threshold rises, and subsequent sounds must be louder to be detected. PTS is an irreversible loss of hearing (permanent damage; not fully recoverable) following exposure that commonly results from inner ear hair cell loss or structural damage to auditory tissues (Saunders et al. 1985; Henderson et al. 2008). PTS has been demonstrated in harbor seals (Reichmuth et al. 2019; Kastak et al. 2008). TTS has been demonstrated in some odontocete and pinniped species in response to exposure to impulsive and non-impulsive noise sources in a laboratory setting (a full review is provided in Southall et al. 2007; Finneran et al. 2017). Prolonged or repeated exposures to sound levels sufficient to induce TTS without recovery time can lead to PTS (Southall et al. 2007).

Table 6-4 outlines the acoustic thresholds for onset of acoustic impacts (PTS and behavioral disturbances) for marine mammals for both impulsive and non-impulsive noise sources. Impulsive noise sources for the Project include some HRG equipment. Non-impulsive noise sources associated with the Project include some HRG equipment, vessel activities, and geotechnical surveys.

Table 6-4. Acoustic marine mammal thresholds (temporary threshold shift [TTS] and permanent threshold shift [PTS]) based on National Marine Fisheries Service (NMFS) (2023i) for Endangered Species Act (ESA)-listed cetaceans

Marine Mammal Hearing Group	Effect	Impulsive Source		Non-Impulsive Source
		Unweighted Lpk (dB re 1 μ Pa)	Weighted SEL24h (dB re 1 μ Pa ² s)	Weighted SEL24h (dB re 1 μ Pa ² s)
LFC	PTS	219	183	199
	TTS	213	168	179
MFC	PTS	230	185	198
	TTS	224	170	178

Source: NMFS 2023k

dB re 1 μ Pa = decibels relative to 1 micropascal; dB re 1 μ Pa²s = decibels relative to 1 micropascal squared second; LFC = low-frequency cetacean; MFC = mid-frequency cetacean; PTS = permanent threshold shift; TTS = temporary threshold shift

Marine mammals show varying levels of behavioral disturbance in response to underwater noise sources. Observed behavioral responses include displacement and avoidance, decreases in vocal activity, and habituation. Behavioral responses can consist of disruption in foraging patterns, increases in physiological stress, and reduced breeding opportunities, among other responses. To better understand and categorize the potential effects of behavioral responses, Southall et al. (2007) developed a behavioral response severity scale of low, moderate, or high (Southall et al. 2007; Finneran et al. 2017). This scale was recently updated in Southall et al. (2021). The revised report updated the single severity response criteria defined in Southall et al. (2007) into three parallel severity tracks that score behavioral responses from 0 to 9. The three severity tracks are (1) survival, (2) reproduction, and (3) foraging. This approach is

acknowledged as being relevant to vital rates, defining behaviors that may affect individual fitness, which may ultimately affect population parameters.

It was noted that not all the responses within a given category need to be observed but that a score is assigned for a severity category if any of the responses in that category are displayed (Southall et al. 2021). To be conservative, the highest (or most severe) score is to be assigned for instances when several responses are observed from different categories. In addition, the Southall et al. (2021) acknowledge it is no longer appropriate to relate “simple all-or-nothing thresholds” to specific received sound levels and behavioral responses across broad taxonomic groupings and sound types due to the high degree of variability within and between species and noise types. The new scale also moves away from distinguishing noise impacts from impulsive versus non-impulsive sound types into considering the specific sources of noise.

Auditory masking occurs when sound signals used by marine mammal overlap in time, space, and frequency with another sound source (Richardson et al. 1995). Masking can reduce communication space, limit the detection of relevant biological cues, and reduce communication or echolocation effectiveness. A growing body of literature is focused on improving the framework for assessing the potential for masking of animal communication by anthropogenic noise and understanding the resulting effects. More research is needed to understand the process of masking, the risk of masking by anthropogenic activities such as sonar emissions, the ecological significance of masking, and what anti-masking strategies are used by marine animals and their degree of effectiveness before masking can be incorporated into regulation strategies or mitigation approaches (Erbe et al. 2016). For the current assessment, masking was considered possible if the frequency of the sound source overlaps with the hearing range of the marine mammal (**Table 6-3**).

6.3.2 Underwater Noise and Sea Turtles

Potential adverse auditory effects to sea turtles from Project generated underwater noise includes PTS, TTS, and behavioral disruption. The section below provides an overview of the available information on sea turtle hearing, the thresholds applied, and the impact consequences for each potential activity.

6.3.2.1 Auditory Criteria for Injury and Disturbance to Sea Turtles

The outermost part of the sea turtle ear, or tympanum, is covered by a thick layer of skin covering a fatty layer that conducts sound in water to the middle and inner ear. This is a distinguishing feature from terrestrial and semi-aquatic turtles. This thick outer layer makes it difficult for turtles to hear well in air, but it facilitates the transfer of sound from the aqueous environment into the ear (Ketten et al. 1999). The middle ear has two components that are encased by bone, the columella and extracolumella, which provides the pathway for sound from the tympanum on the surface of the turtle head to the inner ear. The middle ear is also connected to the throat by the Eustachian tube. The inner ear consists of the cochlea and basilar membrane. Because there is air in the middle ear, it is generally believed that sea turtles detect sound pressure rather than particle motion. Sea turtle ears are described as being similar to a reptilian ear, but due to the historically limited data in sea turtles and reptiles, fish hearing has often been used as an analog when considering potential impacts of underwater sound.

Hearing in sea turtles has been measured through electrophysiological and/or behavioral studies both in air and in water on a limited number of life stages for each of the five species. In general, sea turtles hear best in water between 200 to 750 Hz and do not hear well above 1 kHz. It is worth noting that there are species-specific and life-stage specific differences in sea turtle hearing (**Table 6-5**). Sea turtles are also generally less sensitive to sound than marine mammals, with the most sensitive hearing thresholds underwater measured at or above 75 dB re 1 μ Pa (Papale et al. 2020; Reese et al. 2023). Loggerhead sea turtles have been studied most thoroughly with respect to other species, including post-hatchlings

(Lavender et al. 2012, 2014), juveniles (Bartol et al. 1999; Lavender et al. 2012, 2014), and adults (Martin et al. 2012).

Table 6-5. Hearing capabilities of sea turtles

Species	Life stages tested	Hearing Frequency Range (Hz)	Max sensitivity (Hz)	References
Loggerhead (<i>Caretta caretta</i>)	Post-hatchling, juvenile	100–900 (in air)	500–700	Ketten & Bartol 2005
	Post-hatchling, juvenile, adult	50–1,100 (underwater)	100–400	Bartol & Bartol 2011, Lavender et al. 2014, Martin et al. 2012, Lenhardt 2002, Bartol et al. 1999
Green (<i>Chelonia mydas</i>)	Juvenile, sub-adult	50–2,000 (in air)	200–700	Ridgway et al. 1969; Ketten & Bartol 2005; Piniak et al. 2016
	Juvenile	50–1,600 (underwater)	200–400	Piniak et al. 2016
Leatherback (<i>Dermochelys coriacea</i>)	Hatchling	50–1,600 (in air)	300	Piniak 2012, Piniak et al. 2012
	Hatchling	50–1,200 (underwater)	300	Piniak 2012, Piniak et al. 2012
Kemps ridley (<i>Lepidochelys kempii</i>)	Juvenile	100–500 (in air)	100–200	Ketten & Bartol 2005

As with marine mammals, the potential for underwater noise to result in adverse impacts on a sea turtle depends on the received sound level, the frequency content of the sound relative to the hearing ability of the animal. Potential effects range from subtle changes in behavior at low received levels to strong disturbance effects or potential injury and/or mortality at high received levels. While there is no direct evidence of PTS occurring in sea turtles, TTS has been demonstrated in other marine species in response to exposure to impulsive and non-impulsive noise sources in laboratory studies (a full review is provided in Southall et al. [2007]). Prolonged or repeated exposure to sound levels sufficient to induce TTS without recovery time can lead to PTS (Southall et al. 2007).

Tables 6-6 and 6-7 outline the acoustic thresholds used in the assessment for the onset of PTS, TTS, and behavioral disruptions for sea turtles. Behavioral criteria for both impulsive and non-impulsive sources were developed by the U.S. Navy in consultation with NMFS and was based on exposure to air guns noise presented in McCauley et al. (2000; Finneran et al. 2017). Vessel noise produces non-impulsive, continuous sounds, HRG survey equipment includes both impulsive and non-impulsive, intermittent sources, and geotechnical surveys produce non-impulsive, intermittent sources. In addition, the working group that prepared the ANSI Sound Exposure Guidelines (Popper et al. 2014) provide parametric descriptors of sea turtle behavioral responses to impulsive noise (**Table 6-8**); however, these guidelines were based on pile driving which may not be fully comparable to sources in the proposed activities.

The received sound level at which sea turtles are expected to actively avoid impulsive sounds, an SPL of 175 dB re 1 μ Pa, is also expected to be the received sound level at which sea turtles would actively avoid exposure to both impulsive and non-impulsive sound sources (Finneran et al. 2017). For sea turtles, no distinction is made in the behavioral threshold between impulsive and non-impulsive sources.

Table 6-6. Acoustic impact thresholds¹ for sea turtles – impulsive sources

PTS		TTS		Behavioral ²
L _{pk} Unweighted	SEL _{24h} Weighted	L _{pk} Unweighted	SEL _{24h} Weighted	SPL Unweighted
232	204	226	189	175

Sources: Finneran et al. (2017)

¹ Dual metric thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS onset. If a non-impulsive sound has the potential of exceeding the peak sound pressure level thresholds associated with impulsive sounds, these thresholds are recommended for consideration

² The behavioral disturbance threshold is for all sources – currently, there are not enough data to derive separate thresholds for different source types

L_{pk} = peak sound pressure levels in units of decibels referenced to 1 micropascal; SEL_{24h} = sound exposure level over 24 hours in units of decibels referenced to 1 micropascal squared second; PTS permanent threshold shift; TTS = temporary threshold shift

Table 6-7. Acoustic impact thresholds¹ for sea turtles – non-impulsive sources

PTS	TTS	Behavioral ²
SEL _{24h} Weighted	SEL _{24h} Weighted	SPL Unweighted
220	200	175

Source: Finneran et al. (2017)

¹ Dual metric thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS onset. If a non-impulsive sound has the potential of exceeding the peak sound pressure level thresholds associated with impulsive sounds, these thresholds are recommended for consideration

² Behavioral disturbance threshold applies to all sources – currently, there are not enough data to derive separate thresholds for different source types

SEL_{24h} = sound exposure level over 24 hours in units of decibels referenced to 1 micropascal squared second; PTS = permanent threshold shift; TTS = temporary threshold shift

Table 6-8. Qualitative acoustic impact guidelines for sea turtles

Recoverable Injury	Impairment TTS	Masking	Behavior
Impulsive Sources			
(N) High	(N) High	(N) High	(N) High
(I) Low	(I) Low	(I) Moderate	(I) Moderate
(F) Low	(F) Low	(F) Low	(F) Low
Continuous Sounds			
(N) Low	(N) Moderate	(N) High	(N) High
(I) Low	(I) Low	(I) High	(I) Moderate
(F) Low	(F) Low	(F) Moderate	(F) Low

Source: Popper et al. (2014)

Notes: Relative risk (high, moderate, low) is given for animals at three distances from the source defined in relative terms as near (N-tens of meters), intermediate (I - hundreds of meters), and far (F - thousands of meters). Guidelines are not provided for masking for explosive events since the animals are not exposed to more than a one or few explosive events, and masking would not last beyond the period of exposure. For continuous sounds, data is based on fish, knowing they will respond to sounds and their hearing sensitivity; however, there are no data on exposure or received levels that enable guideline numbers to be provided.

Recoverable injury refers to injuries, including hair cell damage, minor internal or external hematoma, etc. None of these injuries are likely to result in mortality.

6.3.3 Underwater Noise and Marine Fish

Many fishes produce sounds for basic biological functions like attracting a mate and defending territory. A recent study revealed that sound production in fishes has evolved at least 33 times throughout evolutionary time, and that most ray-finned fishes are likely capable of producing sounds (Rice et al. 2022). Fish may produce sounds through a variety of mechanisms, such as vibrating muscles near the swim bladder, rubbing parts of their skeleton together, or snapping their pectoral fin tendons (Ladich and Bass 2011; Rice et al. 2022).

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

All fishes are capable of sensing the particle motion component of underwater sound. The inner ear of fishes is similar to that of all vertebrates. Each ear has three otolithic end organs, which contain a sensory epithelium lined with hair cells, as well as a dense structure called an otolith (Popper et al. 2021). Particle motion is the displacement, or back and forth motion, of water molecules and as it moves the body of the fish (which has a density similar to seawater), the denser otoliths lag behind, creating a shearing force on the hair cells which sends a signal to the brain via the auditory nerve (Fay and Popper 2000). Available research shows that the primary hearing range of most particle-motion sensitive organisms is below 1 kHz (Popper et al. 2021).

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

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

As with marine mammals and sea turtles, fishes may experience a range of impacts from underwater sound depending on physical qualities of the sound source and the environment, as well as the physiological characteristics and the behavioral context of the species of interest. It is important to note that unlike marine mammals, whose hair cells do not regenerate, fishes are able to regrow hair cells that die or become damaged (Corwin 1981), making it extremely likely that they could experience PTS. However, fishes do experience TTS, and when very close to impulsive sound sources or explosions they could experience barotrauma, a term that refers to a class of injuries ranging from recoverable bruises to organ damage, which could ultimately lead to death (Popper et al. 2014; Stephenson et al. 2010). When the air-filled swim bladder inside the body of the fish quickly expands and contracts due to a rapid change in pressure, it can cause internal injuries to the nearby tissues (Halvorsen et al. 2011). The greater the difference between the static pressure at the site of the fish and the positive/negative pressures associated with the sound source, the greater the risk of barotrauma. As with marine mammals, continuous, lower-level sources (e.g., vessel noise) are unlikely to result in auditory injury but could induce changes in behavior or acoustic masking.

The two ESA-listed fish species considered in this BA include the Atlantic sturgeon and Atlantic salmon, as described in **Section 5.1.3**. The Atlantic sturgeon and Atlantic salmon have swim bladders so they are able to detect the sound pressure component of noise but it is not directly connected to their hearing like species of carp or herring and would therefore be less sensitive to underwater sound pressure (Popper et al. 2014).

6.3.3.1 Auditory Criteria for Injury and Disturbance to Marine Fish

The currently available underwater noise exposure thresholds for fish are based on the sound pressure component. However, as discussed previously, all fishes can detect water-borne particle motion. Anthropogenic sounds that interfere with the ability to detect both sound pressure and particle motion could interfere with an animal's ability to detect acoustic cues in its environment (Hawkins et al. 2021). While these potential effects are acknowledged, exposure thresholds for the particle motion component of sound have yet to be developed for fishes (Hawkins et al. 2021). As such, the potential effects on these species from the particle motion component of cannot be fully assessed at this time.

Acoustic criteria to assess the potential effects to fish were developed by the (FHWG 2008) and are presented in **Table 6-9**. These criteria include thresholds for impulsive sources (e.g., some HRG survey equipment) and non-impulsive sources (e.g., vessel noise, geotechnical sampling, some HRG survey equipment). Impulsive criteria include dual metrics which are used to assess the effects to fish exposed to high levels of accumulated energy (SEL_{24h}) for repeated impulsive sounds and a single strike at high L_{pk} . The criteria include a maximum accumulated SEL_{24h} for lower-level signals and a maximum L_{pk} for a single HRG equipment pulse (FHWG 2008). NMFS has not established a formal threshold for behavioral disturbance; however, the SPL threshold of 150 dB re 1 μ Pa threshold is typically used and was applied to all noise sources to assess the behavioral response of fish (Andersson et al. 2007; Wysocki et al. 2007; Mueller-Blenkle et al. 2010; Purser and Radford 2011).

The FHWG was formed in 2004 and consists of biologists from NMFS, USFWS, the Federal Highway Administration (FHWA), USACE, and the California, Washington, and Oregon Departments of Transportation (DOTs), supported by national experts on underwater sound producing activities that

affect fish and wildlife species of concern. In June 2008, the agencies signed a memorandum of agreement (MOA) documenting criterion for assessing physiological effects of impact pile driving on fish. The criteria were developed for the acoustic levels at which physiological effects to fish could be expected and is now applied to multiple source types, not just pile driving. The FHWG outlines thresholds for fish greater and less than 2 g in weight for the onset of physiological effects (Stadler and Woodbury 2009), and not necessarily levels at which fish are mortally damaged. These criteria, provided in **Table 6-9**, were developed to apply to all fish species.

Table 6-9. Thresholds for onset of physiological effects, mortality, and behavioral disturbance for fish from impulsive sources

Marine Fish Type	Physiological Effects ^a		Behavioral Disturbance ^b
	Lpk (dB re 1 μPa)	SEL24h (dB re 1 μPa ² s)	SPL (dB re 1 μPa)
	Impulsive	Impulsive	Impulsive/Non-Impulsive
Fish (≥2 grams)	206	187	150
Fish (<2 grams)	206	183	150

^a From the Fisheries Hydroacoustic Working Group (FHWG 2008).

^b From Andersson et al. (2007); Mueller-Blenke et al. (2010); Purser and Radford (2011); and Wysocki et al. (2007).
 > = greater than; < less than; dB re 1 μPa = decibels referenced to 1 micropascal; dB re 1 μPa²s = decibels referenced to 1 micropascal squared second

6.3.4 Effects from Exposure to Vessel Noise

Vessel sound is characterized as low-frequency, typically below 1,000 Hz with peak frequencies between 10 and 50 Hz, non-impulsive, continuous sound, meaning there are no substantial pauses in the sounds that vessels produce. The acoustic signature produced by a vessel varies based on the type of vessel (e.g., tanker, bulk carrier, tug, container ship) and vessel characteristics (e.g., engine specifications, propeller dimensions and number, length, draft, hull shape, gross tonnage, speed). Larger barges and commissioning vessels would produce lower frequency noise with a primary energy near 40 Hz and underwater source levels that can range from 177 to 200 dB re 1 μPa m (McKenna et al. 2012; Erbe et al. 2019). Smaller crew transfer vessels would typically produce higher-frequency noise (1,000 to 5,000 Hz) at source levels between 150 and 180 dB re 1 μPa m (Kipple and Gabriele 2003, 2004). Vessels using DP thrusters for station-keeping are known to generate substantial underwater noise with source levels ranging from 150 to 180 dB re 1 μPa m depending on operations and thruster use (BOEM 2013; McPherson et al. 2016). Parsons et al. (2021) reviewed literature for the source levels and spectral content of vessels less than 82 ft (25 m) in length, a category often not addressed in vessel noise assessment measurements. Parsons et al. (2021) 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.

6.3.4.1 Marine Mammals

6.3.4.1.1 Effects of Exposure to Noise Above the PTS Thresholds

PTS is unlikely to occur for any ESA-listed marine mammals as a result of vessel noise due to the non-impulsive nature of the sources and relatively low source levels produced (BOEM 2013; McPherson et al. 2016) and is **discountable**. Therefore, the effects of noise exposure above PTS thresholds during Project vessel operations **may affect, not likely to adversely affect** ESA-listed marine mammals.

6.3.4.1.2 Effects of Exposure to Noise Above the Behavioral Threshold

A comprehensive review of the literature (Richardson et al. 1995; Erbe et al. 2019) revealed that most of the reported adverse effects of vessel noise and presence are changes in behavior, though the specific behavioral changes vary widely across species. Physical behavioral responses include changes to dive patterns (e.g., longer dives in beluga whales [Finley et al. 1990]), disruption to resting behavior (harbor seals [Mikkelsen et al. 2019]), increases in swim velocities (belugas [Finley et al. 1990]; humpback whales [Sprogis et al. 2020]; narwhals [*Monodon monoceros*; Williams et al. 2022]), and changes in respiration patterns (longer inter-breath intervals in bottlenose dolphins [Nowacek et al. 2006]; increased breathing synchrony in bottlenose dolphin pods [Hastie et al. 2006]; increased respiration rates in humpback whales [Sprogis et al. 2020]). A playback study of humpback whale mother-calf pairs exposed to varying levels of vessel noise revealed that the mother's respiration rates doubled and swim speeds increased by 37 percent in the high noise conditions (low-frequency weighted received SPL at 100 m was 133 dB re 1 μ Pa) compared to control and low-noise conditions (SPL of 104 dB re 1 μ Pa and 112 dB re 1 μ Pa respectively [Sprogis et al. 2020]). Changes to foraging behavior, which can have a direct effect on an animal's fitness, have been observed in porpoises (Wisniewska et al. 2018) and killer whales (Holt et al. 2021) in response to vessel noise. Thus far, one study has demonstrated a potential correlation between low-frequency anthropogenic noise and physiological stress in baleen whales. Rolland et al. (2012) showed that fecal cortisol levels in NARWs decreased following the 9/11 terrorist attacks, when vessel activity was significantly reduced. Interestingly, NARWs do not seem to avoid vessel noise nor vessel presence (Nowacek et al. 2004), yet they may incur physiological effects as demonstrated by Rolland et al. (2012). This lack of observable response, despite a physiological response, makes it challenging to assess the biological consequences of exposure. In addition, there is evidence that individuals of the same species may have differing responses if the animal has been previously exposed to the sound versus if it is completely novel interaction (Finley et al. 1990). Reactions may also be correlated with other contextual features, such as the number of vessels present, their proximity, speed, direction or pattern of transit, or vessel type. For a more detailed and comprehensive review of the effects of vessel noise on specific marine mammal groups the reader is referred to Erbe et al. (2019).

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. For example, fin whales (Castellote et al. 2012) and belugas (Lesage et al. 1999) have altered frequency characteristics of their calls in the presence of vessel noise. When vessels are present, bottlenose dolphins have increased the number of whistles (Buckstaff 2006; Guerra et al. 2014), while sperm whales decrease the number of clicks (Azzara et al. 2013), and humpbacks and belugas have been seen to completely stop vocal activity (Tsuji et al. 2018; Finley et al. 1990). Some species may change the duration of vocalizations (fin whales shortened their calls [Castellote et al. 2012]) or increase call amplitude (killer whales [Holt et al. 2009]) to avoid acoustic masking from vessel noise.

Understanding the scope of acoustic masking is difficult to observe directly, but several studies have modeled the potential decrease in "communication space" when vessels are present (Clark et al. 2009, Erbe et al. 2016; Putland et al. 2017). For example, Putland et al. (2017) showed that during the closest point of approach (less than 10 km) of a large commercial vessel, the potential communication space of Bryde's whale (*Balaenoptera edeni*) was reduced by 99 percent compared to ambient conditions.

Although there have been many documented behavioral changes in response to vessel noise (Erbe et al. 2019), it is necessary to consider what the biological consequences of those changes may be. One of the first attempts to understand the energetic cost of a change in vocal behavior found that metabolic rates in bottlenose dolphins increased by 20 to 50 percent in comparison to resting metabolic rates (Holt et al. 2015). Although this study was not tied directly to exposure to vessel noise, it provides insight about the potential energetic cost of this type of behavioral change documented in other works (i.e., increases in vocal effort such as louder, longer, or increased number of calls). In another study, the energetic cost of

high-speed escape responses in dolphins was modeled, and the researchers found that the cost per swimming stroke was doubled during such a flight response (Williams et al. 2017). When this sort of behavioral response was also coupled with reduced glide time for beaked whales, the researchers estimated that metabolic rates would increase by 30.5 percent (Williams et al. 2017). Differences in response have been reported both within and among species groups (Finley et al. 1990; Tsujii et al. 2018). Despite demonstrable examples of biological consequences to individuals, there is still a lack of understanding about the strength of the relationship between many of these acute responses and the potential for long-term or population-level effects.

Overall, ESA-listed marine mammals may be exposed to noise above the behavioral thresholds and may experience masking effects depending on the type and speed of the vessel. However, the likelihood of prolonged exposures that would affect biologically important behaviors such as foraging or reproduction is low with the proposed mitigation and monitoring measures (**Section 3.3**) and the limited number of vessels and transits expected (**Table 3-2** and **Table 3-3**). The Proposed Action includes mitigation for vessel strike avoidance (**Section 3.3**) such as minimum separation distances, which would reduce the risk of an animal being close enough to receive sound energy above the behavioral threshold, and vessel speed restrictions, which would help reduce the level of noise produced by Project vessels (ZoBell et al. 2021). With mitigation measures, behavioral disturbance would be so small that they could not be measured, detected, or evaluated and is therefore, **insignificant**; and vessel noise as a result of the Proposed Action **may affect, not likely to adversely affect** ESA-listed marine mammals.

In addition to behavioral disturbance effects that marine mammals may experience in response to Project vessel noise, vessel noise can also affect the existing acoustic soundscape which would encompass Unit 1 of the NARW critical habitat (Section 5.2.1). This area was identified as important for NARW foraging because local oceanographic and biological conditions facilitate aggregations of *C. finmarchicus*, NARW preferred prey species. NARW forage using skim feeding techniques (Section 5.1.1.2) rather than relying on acoustic cues to detect prey like odontocetes (e.g., sperm whales [Section 5.1.1.4]), and any acoustic masking resulting from Project vessel noise would not be expected to limit any NARW ability to find prey. Minimal data are available for zooplankton (the primary prey for NARW) responses to anthropogenic sound. A 2022 study (Guihen et al. 2022) found a noted avoidance of Antarctic krill species to the presence of an autonomous glider carrying a single beam echosounder, however, these disturbances had small ranges (approximately 131 feet [40 meters]). Therefore, given the extent of the effects described and the relatively short duration of the proposed Project vessel activities (2023 through 2025 [Section 3]), any effects on the NARW foraging critical habitat would be so small that they could not be measured, detected, or evaluated and is therefore, **insignificant**; and vessel noise as a result of the Proposed Action **may affect, not likely to adversely affect** NARW critical habitat.

6.3.4.2 Sea Turtles

6.3.4.2.1 Effects of Exposure to Noise Above the PTS Thresholds

Sea turtles are less sensitive to sound compared to faunal groups like marine mammals and no PTS from vessel noise is anticipated under the Proposed Action. It is unlikely that received levels of underwater noise from vessel activities would exceed PTS thresholds for sea turtles, as the PTS threshold for non-impulsive sources is an SEL_{24h} of 200 dB re 1 μPa^2 s (NMFS 2023k) which comparable to the maximum source level reported for large shipping vessels described previously in this section. This means beyond 1 m, the sound level produced by the loudest Project vessel would likely be below the sea turtle PTS threshold and the potential for ESA-listed sea turtles to be exposed to Project vessel noise above PTS thresholds is considered extremely unlikely to occur and is **discountable**. Therefore, the effects of noise exposure above PTS thresholds during Project vessel operations **may affect, not likely to adversely affect** ESA-listed sea turtles.

6.3.4.2.2 Effects of Exposure to Noise Above the Behavioral Threshold

The most likely effects of vessel noise on sea turtles would include behavioral disturbances. There is very little information regarding the behavioral responses of sea turtles to underwater noise. A recent study suggests that sea turtles may exhibit TTS 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 ft (10 m) or closer. Based on the source levels outlined previously, the behavioral threshold for sea turtles is likely to be exceeded by Project vessels. Popper et al. (2014) suggests that in response to continuous shipping sounds, sea turtles have a high risk for behavioral disturbance in the 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. The Proposed Action includes the implementation of minimum vessel separation distance of 164 ft (50 m) for sea turtles which, though geared towards vessel strike avoidance, would help to reduce the level of noise a turtle is exposed to and reducing the likelihood of sea turtles receiving sound energy above the behavioral threshold. The additional BOEM proposed measures to reduce vessel strikes on sea turtles which includes slowing to 4 kn when sea turtle sighted within 328 ft (100 m) of the forward path of the vessel and avoiding transiting through areas of visible jellyfish aggregations or floating sargassum will also reduce the potential for behavioral disturbance effects by reducing the sound level received by sea turtles in the Action Area during vessel activities. Though these mitigation measures will not eliminate the potential for sea turtles to be exposed to above-threshold noise, the potential effects if exposure were to occur would be brief (e.g., a sea turtle may approach the noisy area and divert away from it), and any effects on this brief exposure would be so small that they could not be measured, detected, or evaluated and are, therefore, **insignificant**. Therefore, the effects of noise exposures above behavioral disturbance thresholds during Project vessel operations **may affect, not likely to adversely affect** ESA-listed sea turtles.

6.3.4.3 Marine Fish

6.3.4.3.1 Effects of Exposure to Noise Above the Physiological Injury Thresholds

Research indicates that the effects of vessel noise, including DP vessel noise, will not cause mortality or injuries in adult fish (Hawkins et al. 2014) given the low source levels and non-impulsive nature of this source. The potential for exposures above physiological injury thresholds to occur is extremely unlikely and are **discountable**. Therefore, the effects of exposure to noise above physiological injury thresholds as a result of vessel activity **may affect, not likely to adversely affect** ESA-listed fish species.

6.3.4.3.2 Effects of Exposure to Noise Above the Behavioral Thresholds

Several studies have shown an increase in cortisol, a stress hormone, after playbacks of vessel noise (Wysocki et al. 2006; Nichols et al. 2015; Celi et al. 2016), but other work has shown that the stress of being handled during the experiment itself may induce a greater stress response than an acoustic stimulus (Harding et al. 2020; Staaterman et al. 2020). The overlap in the frequency of vessel noise and fish auditory capabilities could lead to masking of important auditory cues, including conspecific communication (Haver et al. 2021; Parsons et al. 2021). Stanley et al. (2017) demonstrated that the communication range of both haddock and cod (species with swim bladders not involved in hearing) would be significantly reduced in the presence of vessel noise, which is frequent in their habitat in Cape Cod Bay. Generally speaking, species that are sensitive to acoustic pressure would experience masking at greater distances than those that are only sensitive to particle motion (See Affected Environment section for an explanation of fish hearing). Rogers et al. (2021) and (2017) theorize that fish

may be able to use the directional nature of particle motion to extract meaning from short range cues (e.g., other fish vocalizations) even in the presence of distant noise from vessels.

Avoidance of vessels and vessel noise has been observed in several pelagic, schooling fishes, including Atlantic herring (Vabo et al. 2002), Atlantic cod (Handegard et al. 2003) and others (reviewed in De Robertis and Handegard [2013]). Fish may dive toward the seafloor, move horizontally out of the vessel's path, or disperse from their school (De Robertis and Handegard 2013). These types of changes in schooling behavior could render individual fish more vulnerable to predation but these behavioral responses are unlikely to have population-level effects. A more recent body of work has documented other, more subtle behaviors in response to vessel noise, but has focused solely on tropical reef-dwelling fish which are not likely to occur in the Action Area. For example, damselfish antipredator responses (Simpson et al. 2016; Ferrari et al. 2018) and boldness (Holmes et al. 2017) seem to decrease in the presence of vessel noise, while nest-guarding behaviors seem to increase (Nedelec et al. 2017). There is some evidence of habituation, though: Nedelec et al. (2016) found that domino damselfish increased hiding and ventilation rates (i.e., rate of oxygen absorption) after two days of vessel sound playbacks, but responses diminished after one to two weeks, indicating habituation over longer durations.

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

Overall, evidence suggests fish will return to normal baseline behavior faster following exposure to continuous sources such as vessel noise versus intermittent noise (Neo et al. 2014). Therefore, while vessel noise would be present within the Action Area throughout the life of the Proposed Action, behavioral disturbances would only be expected within and few meters of the vessel and would dissipate once the vessel has moved away. In addition, Atlantic salmon and Atlantic sturgeon have swim bladders, which are not involved in hearing (Popper et al. 2014); both species are thought to be more sensitive to particle motion than sound pressure (Popper and Hawkins 2018; Mickle and Higgs 2022). Given the nature of nonimpulsive sources such as vessels noise, particle motion levels sufficient to result in behavioral disturbances would not occur more than a few meters from the source, and any effects to this brief exposure would be so small that they could not be measured, detected, or meaningfully evaluated and are, therefore, **insignificant**. Therefore, the effects from exposure to noise levels above behavioral thresholds resulting from vessel operations **may affect, not likely to adversely affect** ESA-listed fish.

6.3.5 Effects from Exposure to Geotechnical Survey Noise

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 m (Chorney et al. 2011). Geotechnical survey activities would occur over approximately 420 days between March and October 2024.

6.3.5.1 Marine Mammals

6.3.5.1.1 Effects of Exposure to Noise Above the PTS Thresholds

PTS is unlikely to occur for any ESA-listed marine mammals as a result of geotechnical survey noise due to the non-impulsive nature of the sources and relatively low source levels produced (BOEM 2013; McPherson et al. 2016) and is **discountable**. Therefore, the effects of noise exposure above PTS thresholds during the proposed geotechnical surveys **may affect, not likely to adversely affect** ESA-listed marine mammals.

6.3.5.1.2 Effects of Exposure to Noise Above the Behavioral Threshold

Noise produced during the proposed geotechnical surveys would be within the hearing range of ESA-listed marine mammals. Though the estimated source levels do exceed the behavioral disturbance threshold of 160 dB re 1 μ Pa, they would only be exceeded within approximately 65 ft (20 m) 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 mammals species and potential impacts are therefore **discountable**. Therefore, the effects of noise exposure above the behavioral disturbance threshold during the proposed geotechnical surveys **may affect, not likely to adversely affect** ESA-listed marine mammals.

As discussed in Section 6.3.4.1.2, geotechnical survey noise could also affect the existing soundscape of the NARW critical habitat which is located within the Action Area. However, similar to vessel noise, copepods are not expected to show any prolonged changes in distribution to geotechnical survey noise (Guihen et al. 2022), and given that the proposed geotechnical surveys would only occur over 420 days between March and October 2024, no substantial reductions in NARW foraging opportunities are expected within the critical habitat. Therefore, any effects on the NARW foraging critical habitat would be so small that they could not be measured, detected, or evaluated and is therefore, **insignificant**; and geotechnical survey noise as a result of the Proposed Action **may affect, not likely to adversely affect** NARW critical habitat.

6.3.5.2 Sea Turtles

6.3.5.2.1 Effects of Exposure to Noise Above the PTS Thresholds

Sea turtles are less sensitive to sound compared to faunal groups like marine mammals and no PTS from geotechnical survey noise is anticipated under the Proposed Action. It is unlikely that received levels of underwater noise from geotechnical survey activities would exceed PTS thresholds for sea turtles, as the PTS threshold for non-impulsive sources is an SEL_{24h} of 200 dB re 1 μ Pa² s (NMFS 2023k) which comparable to the maximum source level estimated for geotechnical coring equipment described previously in this section. This means beyond 3 ft (1 m), the sound level produced by geotechnical survey activities would likely be below the sea turtle PTS threshold and the potential for ESA-listed sea turtles to be exposed to noise above PTS thresholds is considered extremely unlikely to occur and is **discountable**. Therefore, the effects of noise exposure above PTS thresholds during the proposed geotechnical survey activities **may affect, not likely to adversely affect** ESA-listed sea turtles.

6.3.5.2.2 Effects of Exposure to Noise Above the Behavioral Threshold

Geotechnical surveys using 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 m (Chorney et al. 2011), the behavioral disturbance threshold for sea turtles would only be exceeded within approximately 16 ft (5 m) 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 **discountable**. Therefore, the effects of noise exposure above the behavioral disturbance threshold during the proposed geotechnical survey activities **may affect, not likely to adversely affect** ESA-listed sea turtles.

6.3.5.3 Marine Fish

6.3.5.3.1 Effects of Exposure to Noise Above the Physiological Injury Thresholds

Research indicates that the effects of non-impulsive sound sources, like geotechnical surveys, will not cause mortality or injuries in adult fish (Hawkins et al. 2014) given the low source levels and non-impulsive nature of this source. The potential for exposures above physiological injury thresholds to occur is extremely unlikely and are **discountable**. Therefore, the effects of exposure to noise above physiological injury thresholds as a result of geotechnical survey activity **may affect, not likely to adversely affect** ESA-listed fish species.

6.3.5.3.2 Effects of Exposure to Noise Above the Behavioral Thresholds

The estimated source level of geotechnical survey equipment is above the behavioral disturbance threshold of 150 dB re 1 μ Pa for fish recommended by the Fisheries Hydroacoustic Working Group (2008) and NMFS (2023I), so it could lead to behavioral changes, increased stress, or masking. However, geotechnical surveys would only occur between March and October 2024 and the relatively short duration of these surveys would lower the risk of effects on behaviors relevant for foraging or spawning. Overall, due to the transient and localized nature of this source, the likelihood of geotechnical survey noise on ESA-listed is expected to be **discountable**. Therefore, the effects of exposure to noise above physiological injury thresholds as a result of geotechnical survey activity **may affect, not likely to adversely affect** ESA-listed fish species.

6.3.6 Effects from Exposure to HRG Survey Noise

HRG surveys using some types of impulsive and/or non-impulsive, intermittent SBPs (e.g., UHRS imaging equipment, parametric SBP) may produce noise levels within hearing frequencies and above regulatory hearing thresholds for some marine mammals, sea turtles, and fish. In the 2021 Biological Assessment for Data Collection and Site Survey Activities for Renewable Energy on the Atlantic OCS published by BOEM (Baker and Howsen 2021), estimated distances to auditory injury thresholds were less than 15 m for all equipment and species assessed, and the distance to the behavioral thresholds were a maximum of 500 m for marine mammals during use of sparker systems operating at their maximum power settings for all species. As discussed in **Section 3.1.2.2**, the type of UHRS imaging system has not yet been identified, and because sparker equipment is expected to be louder than the proposed HRG survey equipment, estimates of impact areas from sparkers would represent the maximum potential for effect on marine life from the Proposed Action.

Recently, BOEM and USGS characterized underwater sounds produced by HRG sources and their potential to affect marine mammals (Ruppel et al. 2022). Some geophysical sources can be detected by marine mammals, and subsequently by sea turtles and fish; however, Ruppel et al (2022) also found that only a small number of HRG source categories have the potential to produce sound fields that meet or exceed acoustic thresholds.

6.3.6.1 Marine Mammals

6.3.6.1.1 Effects of Exposure to Noise above the PTS Thresholds

No PTS is expected to occur for any marine mammal species given the small distances to the PTS thresholds and the sound source characteristics of these equipment (Ruppel et al. 2022). Additionally,

both the clearance and shutdown ranges would extend out to 200 m for NARW and 100 m for all other ESA-listed marine mammals, which would fully cover the area over which PTS thresholds may be exceeded (**Section 3.3.8**). Therefore, the potential for PTS exposures during HRG surveys is **discountable** and the effects of noise exposure above PTS thresholds **may affect, not likely to adversely affect** any ESA-listed marine mammals.

6.3.6.1.2 Effects of Exposure to Noise above the Behavioral Threshold

HRG surveys would occur for less than a 1-year period between March and October 2024, with sources operational for up to 270 days (**Section 3.1.2.2**). Although some geophysical sources can be detected by marine mammals, 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 supported empirically: Kates Varghese et al. (2020) found no change in three of four beaked whale foraging behavior metrics (i.e., number of foraging clicks, foraging event duration, click rate) during two deep-water mapping surveys using a 12 kHz multibeam echosounder. There was an increase in the number of foraging events during one of the mapping surveys, but this trend continued after the survey ended, suggesting that the change was more likely in response to another factor, such as the prey field of the beaked whales, than to the mapping survey. During both multibeam mapping surveys, foraging continued in the survey area and the animals did not leave the area (Kates Varghese et al. 2020, 2021). Vires (2011) found no change in Blainville's beaked whale click durations before, during, and after a scientific survey with a 38 kilohertz EK-60 echosounder, while Cholewiak et al. (2017) found a decrease in beaked whale echolocation click detections during use of an EK-60 echosounder and Quick et al. (2017) found that short-finned pilot whales did not change foraging behavior but did increase their heading variance during use of an EK-60 echosounder.

The areas where HRG surveys will occur overlap with Unit 1 of the designated critical habitat for foraging NARWs (**Section 5.2.1**) and would only comprise a small area of the entire designated habitat. There is no designated critical habitat for fin whales, and neither the Southern or Northern Gulf of Maine biologically important foraging area (NOAA 2023x) would overlap with the area in which HRG surveys are likely to occur. Sei whales may be present in the area year-round (**Section 5.1.1.3.2**) and HRG surveys could overlap with foraging animals; however, the HRG source area comprises only a small portion of available habitat so no long-term disruptions to foraging are expected. The area over which HRG surveys would occur would not extend to the outer shelf break where sperm whales are more commonly observed, as evidenced by the low abundance estimates discussed in **Section 5.1.1.4**.

Only a small proportion of HRG sources (e.g., sparkers) have the potential to produce sound levels that exceed behavioral thresholds beyond a few meters from the source (Ruppel et al. 2022). For these sources ESA-listed marine mammals have the potential to be exposed to sound levels that meet or exceed behavioral disturbance thresholds. For the proposed HRG surveys, a 656-foot (200-meter) clearance and shutdown zone for NARW and a 328-foot (100-meter) shutdown zone for all other marine mammals is included under the Proposed Action (**Section 3.3.8**) which would limit the potential for behavioral effects. Given the small distance to the thresholds (Ruppel et al. 2022) and the mitigation measures included in the Proposed Action, above-threshold noise would not be expected impede the use of critical habitat by NARWs or access to foraging habitat for other ESA-listed marine mammals. There may be some masking effects from the HRG sources; however, most masking would be the result of vessel operations and not HRG equipment.

Given the small distances to the behavioral disturbance thresholds and the mitigation included in the Proposed action, exposures, if they were to occur, would be **insignificant**. No changes in biologically important activities. Behavioral changes, if they were to occur, would be temporary and not measurable.

Therefore, effects of exposures above behavioral thresholds from Project HRG surveys **may affect, not likely to adversely affect** ESA-listed marine mammals.

As discussed in Section 6.3.4.1.2, HRG survey noise could also affect the existing soundscape of the NARW critical habitat which is located within the Action Area. However, similar to vessel noise, copepods are not expected to show any prolonged changes in distribution to HRG survey noise (Guihen et al. 2022), and given that the proposed HRG surveys would only occur over approximately 270 days between March and October 2024, no substantial reductions in NARW foraging opportunities are expected within the critical habitat. Therefore, any effects on the NARW foraging critical habitat would be so small that they could not be measured, detected, or evaluated and is therefore, **insignificant**; and HRG noise as a result of the Proposed Action **may affect, not likely to adversely affect** NARW critical habitat.

6.3.6.2 Sea Turtles

6.3.6.2.1 Effects of Exposure to Noise Above the PTS Thresholds

No PTS is expected to occur for any sea turtle species given the small distances to the PTS thresholds and the sound source characteristics of these equipment (Ruppel et al. 2022). Therefore, the potential for PTS exposures during HRG surveys is **discountable** and the effects of noise exposure above PTS thresholds **may affect, not likely to adversely affect** any ESA-listed sea turtles.

6.3.6.2.2 Effects of Exposure to Noise Above the Behavioral Threshold

The behavioral disturbance threshold for sea turtles is higher than that for marine mammals since the threshold is higher, meaning the range to the behavioral threshold is smaller. Only a small proportion of HRG sources (e.g., sparkers) have the potential to produce sound levels that exceed behavioral thresholds beyond a few meters from the source (Ruppel et al. 2022). For these sources ESA-listed sea turtles have the potential to be exposed to sound levels that meet or exceed behavioral disturbance thresholds; however, any effects of exposure to noise above thresholds are transient and would dissipate as the vessel moves away from the turtle. Given the low abundance of sea turtles expected in the Gulf of Maine (Section 5.1.2) and the temporary, transient nature of the HRG surveys (Section 3.1.2.2), the potential for behavioral disturbance to ESA-listed turtles is considered extremely unlikely to occur and is **discountable**. Therefore, the effects of noise exposures above behavioral thresholds during HRG surveys **may affect, not likely to adversely affect** ESA-listed sea turtles.

6.3.6.3 Marine Fish

6.3.6.3.1 Effects of Exposure to Noise Above the Physiological Injury Thresholds

Of the sources that may be used during HRG surveys under the Proposed Action, only boomers and sparkers emit sounds at frequencies that are within the hearing range of most fish (Crocker and Fratantonio 2016; Ruppel et al. 2022), neither of which are included as part of the Proposed Action. For the HRG sources that are audible for fishes, it is important to consider other factors such as source level, beamwidth, and duty cycle when assessing the potential risk of adverse effects (Ruppel et al. 2022). Additionally, Atlantic sturgeon and Atlantic salmon are not expected to be in the Action Area in large numbers, and HRG surveys are not expected in spawning rivers. The closest HRG survey location to a spawning river are those that may occur near the mouth of Penobscot Bay, which is adjacent to the spawning habitat in Penobscot River for both species, but would not overlap. Given the small ranges to thresholds, low abundance, and transient nature of the survey, the potential for physiological injury in ESA-listed fish resulting from HRG surveys are **discountable**. Therefore, effects of noise exposures above physiological injury thresholds during HRG surveys **may affect, not likely to adversely affect** ESA-listed fish.

6.3.6.3.2 Effects of Exposure to Noise Above the Behavioral Threshold

Behavioral impacts could occur over slightly larger spatial scales given the SPL threshold of 150 dB re 1 μ Pa recommended for behavioral disturbance in marine fish (FHWG 2008). However, this threshold does not account for the duration of the exposure, and it is worth noting that these numbers are reported in terms of acoustic pressure because there are currently no behavioral disturbance thresholds for particle motion. Additionally, because HRG equipment are considered intermittent sources, where they are typically “on” for short periods with silence in between, the amount of noise emitted from a moving vessel towing an active acoustic source that would reach fish or invertebrates below is limited, so behavioral effects would be intermittent and temporary. Should an exposure occur, the potential effects would be brief, and no long-term avoidance of the Action Area or effects on reproduction are expected. Effects of this brief exposure could result temporary disruptions to foraging behavior; however, any impacts associated with this avoidance would be so small that they could not be measured, detected, or evaluated and are, therefore, **insignificant**. Therefore, the effects exposure to noise above behavioral thresholds during HRG surveys **may affect, not likely to adversely affect** ESA-listed fish.

6.3.6.4 Effects to Prey

Prey species important to ESA-listed marine mammals, sea turtles, and fish include plankton, squid, small schooling fish, bottom-dwelling fish such as sand lance, crustaceans, and sea grasses. Further details of the primary prey for each species considered in this BA is provided in **Section 5.1**.

Reduction of prey availability could affect marine animals if rising sound levels alter prey abundance, behavior, distribution, or both (McCauley et al. 2000a, 2000b; Popper and Hastings 2009; Slabbekoorn et al. 2010). Prey species may show responses to noise; however, there are limited data on hearing mechanisms and potential effects of noise on common prey species (i.e., crustaceans, cephalopods, fish) that would result loss of availability to marine mammals. These species have been increasingly researched as concern has grown related to noise effects on the food web. Invertebrates appear to be able to detect sounds and particle motion (André et al. 2016; Budelmann 1992; Solé et al. 2016, 2017) and are most sensitive to low-frequency sounds (Packard et al. 1990; Budelmann and Williamson 1994; Lovell et al. 2005a, 2005b; Mooney et al. 2010).

Squid and other cephalopods are an extremely important food chain component for many higher order marine predators, including fin and sperm whales. Cephalopods (i.e., octopus, squid) and decapods (i.e., lobsters, shrimps, crabs) are capable of sensing low-frequency sound. Packard et al. (1990) showed that three species of cephalopod were sensitive to particle motion, not sound pressure, with the lowest particle acceleration thresholds reported as 0.002 to 0.003 m/s^2 at 1 to 2 Hz. Solé et al. (2017) showed that SPL ranging from 139 to 142 dB re 1 μ Pa at one-third octave bands centered at 315 Hz and 400 Hz may be suitable threshold values for trauma onset in cephalopods. Cephalopods have exhibited behavioral responses to low frequency sounds under 1,000 Hz, including inking, locomotor responses, body pattern changes, and changes in respiratory rates (Kaifu et al. 2008; Hu et al. 2009). In squid, Mooney et al. (2010) measured acceleration thresholds of -26 dB re 1 m/s^2 between 100 and 300 Hz and an SPL threshold of 110 dB re 1 μ Pa at 200 Hz. Lovell et al. (2005a) found a similar sensitivity for common prawn (*Palaemon serratus*), SPL of 106 dB re 1 μ Pa at 100 Hz, noting that this was the lowest frequency at which they tested and that the prawns might be more sensitive at frequencies below this. Hearing thresholds at higher frequencies have been reported, such as 134 and 139 dB re 1 μ Pa at 1,000 Hz for the oval squid (*Sepioteuthis lessoniana*) and the common octopus (*Octopus vulgaris*), respectively (Hu et al. 2009). McCauley et al. (2000a) reported that of caged squid exposed to seismic airguns showed behavioral responses such as inking. Wilson et al. (2007) exposed two groups of longfin inshore squid (*Loligo pealeii*) in a tank to killer whale echolocation clicks at SPL from 199 to 226 dB re 1 μ Pa, which resulted in no apparent behavioral effects or any auditory debilitation. However, both the McCauley et al. (2000a) and Wilson et al. (2007) experiments used caged squid, so it is unclear how unconfined animals

would react. André et al. (2011) exposed four cephalopod species (European squid [*Loligo vulgaris*], cuttlefish [*Sepia officinalis*], octopus, and southern shortfin squid [*Ilex coindetii*]) to 2 hours of continuous noise from 50 to 400 Hz at received SPL of 157 dB re 1 μ Pa \pm 5 dB, and reported lesions occurring on the statocyst's sensory hair cells of the exposed animals that increased in severity with time, suggesting that cephalopods are particularly sensitive to low-frequency sound. Similar to André et al. (2011), Solé et al. (2013) conducted a low-frequency (50 to 400 Hz) controlled exposure experiment on two deep-diving squid species (southern shortfin squid and European squid), which resulted in lesions on the statocyst epithelia. Solé et al. (2013) described their findings as "morphological and ultrastructural evidence of a massive acoustic trauma induced by low-frequency sound exposure." In experiments conducted by Samson et al. (2014), cuttlefish exhibited escape responses (i.e., inking, jetting) when exposed to sound frequencies between 80 and 300 Hz with SPL above 140 dB re 1 μ Pa and particle acceleration of 0.01 m/s²; the cuttlefish habituated to repeated 200 Hz sounds. The intensity of the cuttlefish response with the amplitude and frequency of the sound stimulus suggest that cuttlefish possess loudness perception with a maximum sensitivity of approximately 150 Hz (Samson et al. 2014).

Several species of aquatic decapod crustaceans are also known to produce sounds. Popper et al. (2001) concluded that many are able to detect substratum vibrations at sensitivities sufficient to tell the proximity of mates, competitors, or predators. Popper et al. (2001) reviewed behavioral, physiological, anatomical, and ecological aspects of sound and vibration detection by decapod crustaceans and noted that many decapods also have an array of hair-like receptors within and upon the body surface that potentially respond to water- or substrate-borne displacements, as well as proprioceptive organs that could serve secondarily to perceive vibrations. However, the acoustic sensory system of decapod crustaceans remains poorly studied (Popper et al. 2001). Lovell et al. (2005a, 2005b, 2006) reported potential auditory-evoked responses from prawns showing auditory sensitivity of sounds from 100 to 3,000 Hz, and Filiciotto et al. (2016) reported behavioral responses to vessel noise within this frequency range.

Solé et al. (2021) showed that seagrasses may be sensitive to anthropogenic noise. In their study, they exposed Neptune grass (*Posidoniaceae oceanica*) to noise sweeping through 50 to 400 Hz frequencies at received SPL of 157 dB re 1 μ Pa within a few meters (16 ft [less than 5 m]) from the source to the grasses. Neptune grass is a slow-growing seagrass, endemic to the Mediterranean Sea; though is not the same species as the common eelgrass (*Zostera marina*) which is typically found in the Northeastern U.S. Atlantic, they both come from same order (Alismatales) and have similar physiological traits (Biodiversity of the Central Coast 2022). Results show deformed structure of starch grains in the plants studies after 48 hours of noise exposure, and damage to starch grains present after 96 to 120 hours of exposures (Solé et al. 2021). Damage to the starch grains in seagrasses could affect successful growth, and though the sound source used in the study is not the same as many of the noise-producing activities included under the Proposed Action, this shows seagrasses may be affected by low-frequency noise.

Fish are typically sensitive to the 100 to 500 Hz range, which is below most HRG survey sources, but does overlap with many of the Project activities described previously. Several studies have demonstrated that seismic airguns and impulsive sources might affect the behavior of at least some species of fish. For example, field studies by Engås et al. (1996) and Løkkeborg et al. (2012) showed that the catch rate of haddock (*Melanogrammus aeglefinus*) and Atlantic cod (*Gadus morhua*) significantly declined over the 5 days immediately following seismic surveys, after which the catch rate returned to normal. Other studies found only minor responses by fish to noise created during or following seismic surveys, such as a small decline in lesser sand eel (*Ammodytes marinus*) abundance that quickly returned to pre-seismic levels (Hassel et al. 2004) or no permanent changes in the behavior of marine reef fishes (Wardle et al. 2001). However, both Hassel et al. (2004) and Wardle et al. (2001) noted that when fish sensed the airgun firing, they performed a startle response and sometimes fled. Squid (*Sepioteuthis australis*) are an extremely important food chain component for many higher order marine predators, including fin and sperm whales. McCauley et al. (2000a) recorded caged squid responding to airgun signals. Given the

generally low sound levels produced by HRG sources in comparison to airgun sources, no short-term effects on potential prey items (fishes, cephalopods, crustaceans) are expected from the proposed survey activities.

Minimal data are available for zooplankton (the primary prey for NARW) responses to anthropogenic sound. A 2022 study (Guihen et al. 2022) found a noted avoidance of Antarctic krill species to the presence of an autonomous glider carrying a single beam echosounder. However, these disturbances had small ranges (approximately 131 ft [40 m]) and did not show a large-scale movement in krill. It is expected that although reactionary behavior to acoustic disturbance by zooplankton is likely, the localized and temporary nature of the movement would not cause significant loss in the availability of the species to marine mammals.

6.4 Vessel Strike Risk

Vessel strikes are a known source of injury and mortality for marine mammals, sea turtles, and Atlantic sturgeon. Increased vessel activity in the Action Area associated with the survey activities of the Proposed Action would pose a theoretical risk of increased collision-related injury and mortality for ESA-listed species. In general, large vessels traveling at high speeds pose the greatest risk of mortality to ESA-listed marine mammals, whereas sea turtles and sturgeon are vulnerable to a range of vessel types and speeds depending on the environment.

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; Hill et al. 2017; Waring et al. 2011, 2015). NARWs are particularly vulnerable to vessel strikes based on the distribution of preferred coastal region habitats and their 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 kn (Conn and Silber 2013; Kite-Powell et al. 2007; Laist et al. 2001; Vanderlaan and Taggart 2007). Vessels operating at speeds exceeding 10 kn under poor visibility conditions have been associated with the highest risk for vessel strikes of NARWs (Vanderlaan and Taggart 2007), though collisions at lower speeds are still capable of causing serious injury, even when smaller vessels (less than 20 m length) are involved (Kelley et al. 2020).

Vessel strikes are also implicated in sea turtle mortality, with collision risk similarly commensurate with vessel speed although at much lower speeds (Hazel et al. 2007; Shimada et al. 2017). Hazel et al. (2007) found that green sea turtles were unlikely to actively avoid vessels traveling faster than 2.1 kn (4 km/hour), indicating that 10-knot speed restrictions may not be protective for this and potentially other sea turtle species.

Atlantic sturgeon are vulnerable to vessel collisions within restricted riverine habitats resulting in potential mortality (Balazik et al. 2012), though risk in open ocean environments is speculative at best. Vessel strike is not a documented risk for Atlantic salmon (NMFS 2023j); therefore, vessel strike risk under the Proposed Action is expected to have **no effect** on Atlantic salmon.

6.4.1 Project Survey Traffic

BOEM estimates that the total number of vessel trips from routine activities under the Proposed Action would be approximately 1,042 round trips over a 6-year period, which equates to approximately 174 vessel roundtrips per year. While the vessel traffic anticipated as a result of Proposed Action would add to the existing vessel traffic in the region, the estimated number of round trips over the 6-year span is considered a relatively small amount of activity over baseline traffic in the region. Proposed Action vessels would range in size from approximately 37 ft (11 m) to 262 ft (80 m) and include 12- and 24-hour survey vessels, research vessels, commercial fishing vessels, and crew boats. The vessels that would be

used under the Proposed Action are presented in **Sections 3.1.1.2** and **3.1.2.16** of this BA. Some survey vessels would remain at the Research Lease Area or potential cable route region for days or weeks at a time, potentially making infrequent trips to port for bunkering and provisioning as needed. Other vessels would conduct daily transits, departing and returning to port each day. All vessels are expected to travel at speeds slow speeds (i.e., 4 to 7 knots) during surveys, though transits may exceed 10 knots. The majority of vessel transits would originate from either Portland, Maine or Boothbay Harbor, Maine. However, for the purposes of this BA and given that not all ports are yet known, ports located from Plymouth, Massachusetts to Stonington, Maine are considered in this assessment.

The approximately 170 vessel roundtrips per year resulting from the Proposed Action represent 0.4 percent of the average annual vessel tracks counted in the Gulf of Maine from 2019 to 2021 and 78 percent of the average vessels tracks counted in the requested lease area during the same time period. Similarly, the approximately 170 vessel roundtrips per year resulting from the Proposed Action represent 0.4 percent of total commercial vessel counts for the four major ports in the Gulf of Maine from 2017 to 2020. However, as discussed in **Section 3.2.1.1.7**, AIS and VMS data does not capture all vessel activity in a region and is likely to underestimate actual vessel transits, particularly for recreational vessels and smaller commercial fishing vessels.

6.4.1.1 Marine Mammals

Project vessels working under the Proposed Action pose a potential collision risk to marine mammals. Vessel strikes are a well-documented threat to large whales worldwide and are a measurable source of mortality and injury for many marine mammal species (Laist et al. 2001; Vanderlaan and Taggart 2007; Martin et al. 2016; Hayes et al. 2022), indicating the importance of protective measures to minimize risks to vulnerable species. Vessel strikes are of particular concern for mysticetes due to their size, relatively slow maneuverability, proportion of time spent at the surface between dives, lack of clear and consistent avoidance behavior, and their relatively low detectability by vessels without focused observation efforts and (Garrison et al. 2022; Gende et al. 2011; Rockwood et al 2017; Martin et al 2016). Vessel strikes are a known or suspected contributor to three active unusual mortality events in the Atlantic Ocean for cetaceans (humpback whale, minke whale, and NARW) (NMFS 20231).

If a vessel strike does occur, the impact on marine mammals would range from minor injury to mortality of an individual, depending on the species and severity of the strike. Injuries are typically the result of one of two mechanisms: either blunt force trauma from impact with the vessel, or lacerations from contact with the propellers (Wiley et al. 2016). Depending on the severity of the strike and the injuries inflicted, the animal may or may not recover (Wiley et al. 2016). The size of the vessel and animal, speed of the vessel, and the orientation of the marine mammal with respect to vessel trajectory will all affect the severity of the injury (Vanderlaan and Taggart 2007; Martin et al. 2016).

The ability for vessel operators to detect a marine mammal within the path of the moving vessel can reduce vessel strike risk and is dependent on a variety of factors, including atmospheric/visibility conditions, observer training and experience, and vessel size and speed. Vessel speed is inversely correlated with detection rates, such that slower transit speeds, especially those below 9.7 kn (5.0 m/s), generally lead to a higher in-time detection rates for most vessel sizes provided adequate (3,281 ft [greater than 1,000 m]) reliable detection ranges (Baille and Zitterbart 2022).

Almost all sizes and classes of vessels have been involved in collisions with marine mammals around the world, including large container ships, ferries, cruise ships, military vessels, recreational vessels, commercial fishing boats, whale-watch vessels, research vessels and even jet skis (Dolman et al. 2006; Winkler et al. 2020).

Primary factors that affect the probability of a marine mammal-vessel strike include:

- Density, distribution, species, age, size, speed, health, and behavior of animal(s) (Vanderlaan and Taggart 2007; Martin et al. 2016);
- Number, speed, and size of vessel(s) (Vanderlaan and Taggart 2007; Martin et al. 2016);
- Vessel path (Vanderlaan and Taggart 2007; Martin et al. 2016);
- Operator's ability to detect and avoid collisions (Martin et al. 2016; Williams et al. 2016); and
- Animal's ability to detect an approaching vessel and propensity to avoid collisions (Gende et al. 2019; McKenna et al. 2015; Nowacek et al. 2004).

A marine mammal's ability to detect and actively avoid a vessel collision is poorly understood. An individual's aversion to an approaching vessel is likely dependent on the age and behavioral state of the animal and will differ among species (Gende et al. 2019; McKenna et al. 2015; Nowacek et al. 2004). Auditory recognition of a vessel by a marine mammal such that timely avoidance is triggered is likely highly variable and highly contextual. The following factors can impair the ability of a marine mammal to detect and locate the sound of an approaching vessel:

- Attenuation of low frequency vessel sound near the surface (i.e., Lloyd mirror effect);
- Decreased propeller sound at the bow as a vessel's length increases (i.e., spreading loss);
- Impedance of forward-projecting propeller sound due to hull shape and relative placement of keel (above-keel propeller location resulting in acoustic shadowing); and
- Ambient (background) sound interfering with the sound of an approaching vessel (i.e., acoustic masking).

Vessel speed and size are two of the most important factors for determining the probability and severity of vessel strikes. The size and bulk of the large vessels inhibits the ability for crew to detect and react to marine mammals along the vessel's transit route. In 93 percent of marine mammal collisions with large vessels reported in Laist et al. (2001), whales were either not seen beforehand, or were seen too late to be avoided. Laist et al. (2001) reported that the most lethal or severe injuries are caused by ships 262 ft (80 m) or longer traveling at speeds greater than 13 kn (6.7 m/s). An analysis conducted by Conn and Silber (2013) built upon collision data collected by Vanderlaan and Taggart (2007) and Pace and Silber (2005) and included new observations of serious injury to marine mammals as a result of vessel strikes at lower speeds (e.g., 2 and 5.5 kn [1.0 and 2.8 m/s]). The relationship between lethality and strike speed was still evident; the probability of a vessel strike increases significantly as speeds increase above 10 kn (Conn and Silber 2013; Kite-Powell et al. 2007; Laist et al. 2001; Vanderlaan and Taggart 2007). Smaller vessels have also been involved in marine mammal collisions. Minke, humpback, and fin whales have been killed or fatally wounded by whale-watching vessels around the world (Jensen and Silber 2003). Strikes have occurred when whale watching boats were actively watching whales as well as when they were transiting through an area, with the majority of reported incidences occurring during active whale watching activities (Laist et al. 2001; Jensen and Silber 2004).

In general, ESA-listed marine mammal densities within the Action Area range from relatively low to seasonally high. Fin whale densities are the greatest whereas NARW and sei whale densities are comparatively lower; sperm whale densities are the lowest. Fin whales are common and widespread throughout the Gulf of Maine, with highest abundances during summer and fall (MGEL, 2022). NARWs are also common in the Gulf of Maine; visual and acoustic surveys area indicate that NARWs may be present year-round in the Gulf of Maine, though the highest abundances occur from mid-fall through early summer (NMFS, 2023a; MGEL, 2022; Davis et al., 2017). Sei whales typically express irregular

movement patterns that appear to be associated with oceanic fronts, sea surface temperatures, and specific bathymetric features (Olsen et al., 2009; Hayes et al., 2022); the species is considered regular in the Gulf of Maine, with higher, though variable, densities from spring through fall (MGEL, 2022). Sperm whales are primarily found in deeper offshore waters near the continental shelf 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 during the summer to early fall months (MGEL, 2022).

A range of mitigation and monitoring measures to minimize the potential for vessel collisions and impacts to marine mammals are included under the Proposed Action (**Section 3.3**). Specific to mitigating for vessel strike, **Section 3.3.3.4** describes all conditions under the Proposed Action for protected species detection and vessel strike avoidance conditions. Specifically, the following measures serve to reduce the likelihood of a vessel strike when effectively implemented:

- Project-specific training to all vessel crew members, Visual Observers, and Trained Lookouts on the identification of sea turtles and marine mammals, vessel strike avoidance and reporting protocols, and the associated regulations for avoiding vessel collisions with protected species.
- Alternative monitoring technology (e.g., night vision, thermal cameras, etc.) must be available to maintain a vigilant watch at night and in any other low visibility conditions.
- Vessels of all sizes must operate at 10 knots or less between November 1 and April 30 and while operating port to port and operating in the lease area, or in the transit area to and from ports in Maine, New Hampshire, and Massachusetts.
- Regardless of vessel size, vessel operators must reduce vessel speed to 10 knots (11.5 mph) or less while operating in any SMA or DMA or visually detected Slow Zones. Additionally, any proposed revisions to the NARW speed rule will be followed upon Rule adoption.
- Regardless of vessel size, the vessel captain and crew must maintain a vigilant watch for all protected species and slow down, stop their vessel, or alter course, as appropriate, to avoid striking any listed species.
- Minimum separation distances and strike avoidance protocols are established in **Section 3.3.3.4**, and includes a 1,640 ft (500 m) separation from all ESA-listed whales or large unidentified whales.

While the baseline encounter rate for vessels and animals to be within a strike risk with one another is already low, several additional factors are expected to further reduce the probability of a Proposed Action-related vessel strike. The communication and reporting procedures outlined in **Section 3.3.6** are designed to increase awareness to the presence of marine mammals, and NARWs in particular. All Project-related vessels operating in the Action Area are required to post trained and dedicated lookouts onboard that will utilize the best available tools and/or technology to continuously monitor the vessel strike zone anytime a vessel is underway. All protected species sightings will be shared among all Project vessels to increase situational awareness to the presence of marine mammals. Although the Proposed Action will result in a temporary increase in the number of vessels operating in the Action Area, data sharing amongst all vessels will be beneficial to each trained lookout. When combined with the effective implementation of vessel strike avoidance mitigation measures, encounters that have a high risk of resulting in collision or injury would be minimized by reducing both the encounter potential (e.g., separation distances, seasonal restrictions, avoidance of aggregations) and severity potential (e.g., speed reduction, vessel positioning parallel to animals). Slower operational speeds of less than or equal to 10 kn would allow whales to avoid vessels, vessels to avoid whales, or both to take evasive actions. Additionally, slower vessel speeds are generally correlated with a reduction in injury extent and reduced instances of mortality when compared to faster vessel speeds (Vanderlaan and Taggart 2007). All vessels, including those traveling faster than 10 kn when permitted to do so, are required to maintain

minimum separation distances of 1,640 ft (500 m) from all observed ESA-listed whales. While this measure cannot entirely eliminate an undetected marine mammal from entering this zone, a reduction in strike/injury risk ultimately relies on the ability for a responsive action to be taken if there is an encounter with a marine mammal. The deployment of trained lookouts on all vessels along with operable and effective monitoring equipment, including equipment specialized for low-light conditions (i.e., thermal imaging, night vision devices) in order to effectively monitor at night, will serve to minimize the collision and injury risk of any encounters that may occur.

Seasonally high densities of ESA-listed whales, specifically fin whales and NARWs, are possible within the Action Area. However, the contribution of the number of vessel trips under the Project compared to current baseline levels in the Action Area is considered very low for both site assessment and site characterization activities combined. In addition, the mitigation measures outlined above and in **Section 3.3.3.4** are expected to minimize potential interactions with ESA-listed species during vessel movements when properly and fully implemented. As a result, there is a low risk of interaction between marine mammals and Project vessel traffic during site assessment and site characterization activities based on the estimated vessel activity over the total activity period and the effective implementation of mitigation measures.

The risk of vessel strike cannot be fully eliminated due to the unpredictable nature of animal-vessel interactions, even with dedicated observers. However, vessel strike risk, and importantly, injury resulting from vessel strikes, can be significantly reduced to a negligible level by strict adherence to the guidelines and proposed mitigation measures outlined in the vessel strike avoidance measures in **Section 3.3.3.4**. Therefore, vessel strike risk is low, but not eliminated, when monitoring and mitigation activities are effectively implemented, as outlined; and trained, dedicated lookouts are used on all vessels. With full implementation of mitigation measures, the potential for injury-causing vessel strikes to ESA-listed marine mammals is considered **insignificant**. Therefore, the effects of Project-related vessel traffic **may affect, not likely to adversely affect** ESA-listed marine mammals.

6.4.1.2 Sea Turtles

Vessels working under the Proposed Action pose a potential collision risk to sea turtles. Vessel-animal collisions are a measurable and increasing source of mortality and injury for sea turtles; the percentage of stranded loggerhead sea turtles with injuries that were apparently caused by vessel strikes increased from approximately 10 percent in the 1980s to over 20 percent in 2004, although some stranded turtles may have been struck post-mortem (NMFS and USFWS 2008). 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 kn (1 m/s) (Hazel et al. 2007). The recovery plan for loggerhead sea turtles (NMFS and USFWS 2008) notes that, from 1997 to 2005, 14.9 percent of all stranded loggerheads in the U.S. Atlantic and Gulf of Mexico were documented as having some type of propeller or collision injuries, although it is not known what proportion of these injuries occurred before or after the turtle died. Regardless, increased vessel traffic associated with the Proposed Action may increase the potential for impacts from vessel strikes.

Vessels traveling at higher speeds pose a higher risk to sea turtles. Relative to marine mammals, as discussed in **Section 6.4.1.1**, sea turtles require more stringent speed reductions before lethal injury probabilities are reduced. To reduce the risk of lethal injury to loggerhead sea turtles from vessel strikes by 50 percent, Sapp (2010) found that small vessels (10 to 30 ft [3 to 6 m] in length) had to slow down to 7.5 kn (3.9 m/s); the probability of lethal injury decreased by 60 percent for vessels idling at 4 kn (2.1 m/s). Foley et al. (2008) further indicated that vessel speed greater than 4 kn (2.1 m/s) may cause serious injury or mortality to sea turtles. The most informative study of the relationship between ship speed and collision risk was conducted on green sea turtles (Hazel et al. 2007). Green sea turtles often failed to flee approaching vessels. Hazel et al. (2007) concluded that green sea turtles rarely fled when

encountering fast vessels (greater than 10 kn [5 m/s]), infrequently fled when encountering vessels at moderate speeds of around 6 kn (3.1 m/s), and frequently fled when encountering vessels at slow speeds of approximately 2 kn (1 m/s). Based on the observed responses of green sea turtles to approaching boats, Hazel et al. (2007) further concluded that sea turtles rely primarily on vision rather than hearing to avoid vessels; although both may play a role in eliciting responses, sea turtles may habituate to vessel sound and be more likely to respond to the sight of a vessel rather than the sound of a vessel. The potential for collisions between vessels and sea turtles, thus, increases at night and during inclement weather. Based on these findings, vessel speed restrictions may be inconsequential to reducing strike risk at anything but the slowest speeds (less than 2 kn [1 m/s]) due to the relatively low rate of flee responses of sea turtles.

The contribution of the number of vessel trips under the Proposed Action compared to current baseline levels in the Action Area is considered very low for both site assessment and site characterization activities combined. Additionally, sea turtle densities within the Gulf of Maine are relatively low and seasonal, with occurrence rates for all ESA-listed sea turtle species limited to summer and fall months. As a result, there is a low risk of interaction between ESA-listed sea turtles and project vessel traffic during Project activities based on the relative occurrence of sea turtles in the Action Area and the estimated vessel activity during site assessment and site characterization activities.

There are limited measures that have been proven to be effective at reducing collisions between sea turtles and vessels (Schoeman et al. 2020). The relatively small size of turtles and the significant time spent below the surface makes their observation by vessel operators extremely difficult, therefore reducing the effectiveness of trained 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 observer requirements discussed in **Section 6.4.1.1** for marine mammals, strike avoidance measures that are specifically geared towards sea turtles (**Section 3.3.3.4**) include:

- Vessels must slow down to 4 knots if a sea turtle is sighted within 328 ft (100 m) of the operating vessel's forward path.
- Between June 1 and November 30, all vessels must avoid transiting through areas of visible jellyfish aggregations or floating vegetation (e.g., sargassum lines or mats). In the event that operational safety prevents avoidance of such areas, vessels must slow to 4 knots while transiting through such areas.
- All vessel crew members must be briefed on the identification of sea turtles and on regulations and best practices for avoiding vessel collisions. Reference materials must be available aboard all Project vessels for identification of sea turtles.

Although vessel strike risk to sea turtles is expected to be reduced with the application of monitoring and mitigation measures, some unavoidable effects on sea turtles may occur, primarily due to the difficulty in detecting sea turtles. Though vessel speed restrictions are designed primarily to reduce impact to marine mammals, they would also reduce potential impacts to sea turtles. However, sea turtle collisions may still occur at slow speeds, and individuals would still be vulnerable when vessels travel over 2 kn (1 m/s). Additionally, effective detection of sea turtles in low visibility conditions (nighttime, fog, inclement weather) is likely low, even with the application of alternative monitoring technologies, thereby increasing the vulnerability of sea turtles to vessel strike risk during these periods, even with all other mitigative measures implemented.

The increase in vessel traffic associated with the Proposed Action is likely to increase the relative risk of vessel strike for sea turtles, particularly during nighttime and periods of reduced visibility. However, given the relatively low levels of vessel traffic expected under the Proposed Action and the low sea turtle densities in the Action Area, strike risk, though not fully eliminated, is not expected to exceed negligible levels. The seasonal patterns of sea turtles in the region will result in a reduction in risk during periods of time when individuals are less likely to be present, such as during winter months. Mitigation measures

(e.g., minimum vessel separation distances, vessel speed restrictions) would reduce the overall encounter potential. The deployment of trained observers on all vessels along with operable and effective monitoring equipment would additionally contribute to minimizing the collision risk with sea turtles. As a result, the probability of a vessel strike between Project vessels and sea turtles under the Proposed Action would be **insignificant**. Therefore, the effects of Project-related vessel traffic **may affect, not likely to adversely affect** ESA-listed sea turtles.

6.4.1.3 Marine Fish

Propeller-driven vessels and barges can pose a risk to fishes that swim near the water surface and are a potential source of mortality for Atlantic sturgeon due to direct collisions with the vessel's hull or propeller (Brown and Murphy 2010). The majority of vessel-related Atlantic sturgeon mortality is likely caused by large transoceanic vessels in river channels (Brown and Murphy 2010; Balazik et al. 2012). Large vessels have been implicated because of their deep draft (up to 40 to 45 ft) relative to smaller vessels (15 ft), which increases the probability of vessel collision with demersal fishes like Atlantic sturgeon, even in deep water (Brown and Murphy 2010). Although smaller vessels and those with relatively shallow drafts provide more clearance with the river bottom, they can operate at a higher speed, which is expected to limit a sturgeons' ability to avoid being struck.

Atlantic sturgeon strikes are most likely to occur in areas where Atlantic sturgeon populations overlap with abundant boat traffic such as large ports or areas with relatively narrow waterways (ASSRT 2007). A recent study indicated that the loss of only a few adult female Atlantic sturgeon from the Delaware River riverine population because of vessel strikes would hinder recovery of that riverine population (Brown and Murphy 2010). While Atlantic sturgeon are known to be struck and killed by vessels in rivers and estuaries, there are no reports of vessel strikes in the marine environment, likely due to the space between bottom-oriented sturgeon and the propellers and hull of vessels (BOEM 2019). The representative ports and vessels under consideration for the Project are described in **Sections 3.1.1.2 and 3.1.2.16**. The potential occurrence of the Atlantic sturgeon species near ports and shallow navigation channels are expected to be the areas of highest risk for vessel interaction with this benthic-dwelling species. However, their limited presence at the water's surface and the dispersed nature of vessel traffic and individual sturgeon reduces the potential for co-occurrence of individual sturgeon and individual vessels. Additionally, vessel transits within riverine habitat are not considered under the Proposed Action, further reducing the co-occurrence of Project-related vessels with Atlantic sturgeon. Based on the best available information on vessel strike risks associated with the Proposed Action, we find that risk of vessel strikes with Atlantic sturgeon is extremely unlikely to occur.

There are limited measures that would be effective at reducing collisions between ESA-listed fish and vessels; the time spent below the surface makes their observation by vessel operators extremely difficult, therefore reducing the effectiveness of trained observers to mitigate vessel strike risk. Nevertheless, the use of trained lookouts and other monitoring and mitigation measures such as vessel speed restrictions would serve to reduce potential collisions. However, some unavoidable effects on ESA-listed fish may occur, primarily due to the difficulty in detecting ESA-listed fish. Therefore, the measures discussed above are assumed to provide limited effectiveness at reducing vessel strike risk to ESA-listed fish.

The increase in vessel traffic associated with site assessment and site characterization activities under the Proposed Action is likely to increase the relative risk of vessel strike for Atlantic sturgeon. However, given their limited presence at the water's surface and the dispersed occurrence throughout the Action Area, the rate of co-occurrence with one related vessel traffic is expected to be very low for Atlantic sturgeon. As such, the risk of vessel strikes is assumed to be extremely low, and impacts, if any, would be **discountable**. Therefore, the effects of Project-related vessel traffic **may affect, not likely to adversely affect** Atlantic sturgeon.

As indicated previously, vessel strike is not a documented risk for Atlantic salmon (NMFS 2023j); therefore, vessel strike risk under the Proposed Action is expected to have **no effect** on Atlantic salmon.

6.5 Habitat Disturbance

6.5.1 Temporary Seafloor Disturbances

Temporary disturbances of the seafloor during the proposed site assessment and site characterization activities would result from the placement and removal of the FLiDAR buoy, geotechnical surveys, benthic surveys, and vessel anchoring. The total estimated area of temporary seafloor disturbance resulting from the Proposed Action during these survey activities is provided in **Table 6-10**.

Table 6-10. Estimated temporary seafloor disturbance resulting from the site assessment and site characterization activities for the Proposed Action

Activity	Disturbance Area
FLiDAR Buoy	32 ft ² (3 m ²)
Geotechnical Surveys	Up to hundreds of ft ² (several m ²) per sample
Benthic Surveys	Up to hundreds of ft ² (several m ²) per grab
Vessel anchoring	Up to hundreds of ft ² (several m ²) per anchor

Source: Draft EA Section 2.2, BOEM 2023a

Restoration of marine soft-sediment habitats occurs through a range of physical (e.g., currents, wave action) and biological (e.g., bioturbation, tube building) processes (Dernie et al. 2003). In areas of seafloor disturbance, benthic habitat recovery and mobile and sessile benthic infaunal and epifaunal species abundances may take 1 to 3 years to recover to preimpact levels, based on the results of a number of studies on benthic recovery (e.g., AKRF et al. 2012; Carey et al. 2020; Germano et al. 1994; Guarinello and Carey 2022; Hirsch et al. 1978; Kenny and Rees 1994; Department for Business, Enterprise and Regulatory Reform 2008; Collie et al. 2000; Gerdes et al. 2008). Based on a review of impacts of sand mining in the U.S. Atlantic and Gulf of Mexico, softbottom communities within the cable corridors would recover within 3 months to 2.5 years (Brooks et al. 2006; Kraus and Carter 2018; Normandeau Associates 2014). However, it is important to note that the actual mechanisms of recovery are highly complex and site-specific; recovery to baseline conditions may take much longer in some areas and for some benthic species. Generally, soft-bottom habitats are more rapidly restored following a disturbance compared to complex or hard-bottom habitats (Collie et al. 2000).

Benthic habitat recolonization rates depend on the benthic communities in the area surrounding the affected region. The Action Area comprises both rocky sediment with sand and gravel deposits with muddy sediment deposits over large areas (**Section 3.2.1.1.2**). Previous surveys have found silt and sand was the most common sediment type found in the Research Lease Area and sand concentrations are also common in nearshore areas less than 164 ft (50 m) depth (**Section 3.2.1.1.2**). Areas of coarser sediment are often more dynamic in nature and therefore quicker to recover following a disturbance than more stable environments such as those with fine-grained sediment or rocky reefs (Dernie et al. 2003). Species inhabiting these dynamic habitats are adapted to deal with physical disturbances, for example, frequent sedimentation associated with strong bottom currents and ground swell. As such, these communities are expected to recolonize more quickly after a disturbance than communities not well-adapted to frequent disturbance (e.g., cobble and boulder habitats). Mobile species may be indirectly affected by the temporary reduction of benthic forage species; however, given the prevalence of similar habitat in the area, this is likely to have a nominal effect.

6.5.1.1 Marine Mammals

Given the range of benthic habitat present in the Action Area (**Section 3.2.1.1.2**), some displacement of benthic prey resources for marine mammals may occur, but this is expected to be temporary. Seafloor disturbances for the Proposed Action could be on the order of tens of thousands of square feet (thousands of square meters) assuming several hundred geotechnical samples and benthic grabs are required and each result in a disturbance of hundreds of square feet (several square meters) (**Table 6-10**).

The only forage fish species for marine mammals that is expected to be impacted by the physical disturbance of sediment would be benthic fish species like the sand lance. The only marine mammal species that is expected to feed on benthic prey species are fin whales, which may feed on sand lance in the Action Area (**Section 5.1.1.1**). There are two biologically important foraging areas identified for fin whales within the Gulf of Maine: the Southern Gulf of Maine BIA, which only overlaps with potential vessel transits where fin whales forage year round; and the Northern Gulf of Maine BIA, which partially overlaps with the proposed benthic surveys where fin whales forage between June and October (LaBrecque et al. 2015). However, only a small portion of the Northern Gulf of Maine BIA overlaps with the area in which benthic surveys may occur in the Penobscot Bay area; only a minimal amount of seafloor disturbances within this area are expected. Additionally, there is no evidence to suggest that fin whales occurring within this region feed exclusively on sand lance; the species is expected to utilize other pelagic prey resources within the Action Area, which would therefore minimize potential impact as a result of potential seafloor disturbances.

Given the limited overlap with important benthic feeding habitats for ESA-listed marine mammals, and the temporary, localized nature of the disturbance, effects from seafloor disturbance would be so small that they could not be meaningfully measured, detected, or evaluated and are **insignificant**. Therefore, effects of seafloor disturbance from the Proposed Action **may affect, not likely to adversely affect** ESA-listed marine mammals.

6.5.1.2 Sea Turtles

The site assessment and characterization surveys of the Proposed Action would result in temporary disturbances of the seafloor within the Action Area as provided in **Table 6-10**. After the survey activities are completed, the areas of temporary disturbance should return to the baseline state. Seafloor disturbances could directly impact benthic species such as mollusks and crabs, which are prey for some sea turtle species (**Section 5.1.2**). Leatherback sea turtles (**Section 5.1.2.3**) are dietary specialists, feeding almost exclusively on pelagic jellyfish, salps, and siphonophores, rather than prey species affected by benthic habitat alteration.

Green, Kemp's ridley, and loggerhead sea turtles all may feed on benthic organisms, though some degree of behavioral plasticity is evident for all species. Once mature, green sea turtles leave pelagic habitats and enter benthic foraging grounds, primarily feeding on seagrasses and algae (Bjorndal 1997), although they will occasionally feed on sponges and invertebrates (NMFS 2022d). 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). Although loggerheads are dietary specialists, the species demonstrates the ability to adjust its diet in response to changes in prey availability in different geographies (Plotkin et al. 1993; Ruckdeschel and Shoop 1988); juvenile loggerhead sea turtles are likely better adept at responding to changing environmental conditions than adults (Cardona et al. 2017).

Benthic habitat disturbances are anticipated to be temporary and localized (**Table 6-10**) and unlikely to affect the availability of prey resources for these species. Although the Proposed Action would temporarily impact benthic prey resources, those effects would be temporary and limited to a very small

percentage of the Action Area. Given that the Action Area is naturally dynamic and exposed to anthropogenic disturbance (**Section 3.2.1**), the individuals that do occur in this region are expected to be able to adjust their foraging behavior based on prey availability. Green and Kemp's ridley sea turtles are omnivorous species with flexible diets, and loggerhead sea turtles readily target new prey species to adapt to changing conditions. Additionally, as discussed in **Section 5.1.2**, green, Kemp's ridley, and loggerhead sea turtle occurrence within the Gulf of Maine is quite low, indicating the region is not current a critical foraging habitat for large numbers of individuals.

Given the limited amount of foraging habitat exposed to seafloor disturbances, the temporary and localized nature of these effects, and the ability of these species to adjust their diet in response to resource availability, the resulting effects of temporary seafloor disturbance on these species would be **insignificant and may affect, not likely to adversely affect** ESA-listed sea turtles.

6.5.1.3 Marine Fish

The site assessment and site characterization activities of the Proposed action would result in temporary and permeant disturbances of the seafloor within the Action Area as provided in **Table 6-10**. After the survey activities are completed, the areas of temporary disturbance should return to the baseline state. Although the Proposed Action would kill or displace preferential prey organisms (invertebrates, such as crustaceans, worms, and mollusks, and bottom-dwelling fish, such as sand lance) within the survey footprint, these effects would be temporary in duration and limited to a very small area of available foraging habitat in the Action Area.

Atlantic sturgeon are known to eat a variety of benthic organisms and are believed to be opportunistic feeders with stomach contents ranging from mollusks, worms, amphipods, isopods, shrimp, and small benthic fish (e.g., sand lance; Smith 1985; Johnson et al. 1997; Dadswell 2006; Novak et al. 2017). Generally, the disturbance of benthic habitat would be short term and localized (**Table 6-10**), with an abundance of similar foraging habitat and prey available in adjacent areas for Atlantic sturgeon. As discussed in **Section 5.1.3.1.2**, Atlantic sturgeon in the Gulf of Maine would primarily inhabit coastal waters and spawning rivers, so there would be minimal overlap with foraging sturgeon and the proposed benthic and geotechnical surveys. Given their generalist feeding behaviors and the limited total area of potential habitat disturbance, Atlantic sturgeon are unlikely to be affected by the effects of short-term, localized, seabed disturbance. Atlantic salmon prey vary based on their age; adults prefer capelin, which is a pelagic species, while juveniles forage on insects, invertebrates, and plankton (NMFS 2023j). As discussed in **Section 5.1.3.2.2**, juveniles spend two or three years in freshwater before migrating across the Gulf of Maine to their offshore foraging areas near Greenland. Therefore, Atlantic salmon occurring in the benthic and geotechnical sampling areas would be minimal and a low number of them would likely be foraging on benthic prey species.

Given the limited extent of effects and the likelihood of rapid recovery to baseline benthic community conditions, the effects of seafloor disturbance from the Proposed Action are likely to be **insignificant and may affect, not likely to adversely affect** ESA-listed fish.

6.5.2 Turbidity

The site assessment and site characterization surveys of the Proposed Action are likely to result in elevated levels of turbidity in the immediate proximity of seafloor-disturbing activities like placement and removal of the FLiDAR buoy, geotechnical surveys, benthic surveys, and vessel anchoring. There would be temporary increases in sediment suspension and deposition during activities that entail the disturbance of the seafloor. The Proposed Action could be on the order of tens of thousands of square feet (thousands of square meters) assuming several hundred geotechnical samples and benthic grabs are required and each results in a disturbances are of hundreds of square feet (several square meters) (**Table 6-10**). However,

only a few benthic grabs and geotechnical coring samples would be expected per day, only one FLiDAR buoy would be placed and removed between June 2023 and June 2025. Vessel anchoring is likely to be minimal per day throughout the duration of the Proposed Action. Given the nature of these activities, the increases in turbidity are not likely to persist beyond a few hours, so cumulative increases in turbidity from day to day would not occur, and the increased total suspended solids (TSS) for each day of sampling would likely be experienced by marine life as discrete and temporary events.

6.5.2.1 Marine Mammals

The NMFS Atlantic Region has developed a policy statement on turbidity and TSS effects on ESA-listed species for the purpose of Section 7 consultation (Johnson 2018). The agency concluded that elevated TSS could result in effects on listed whale species under specific circumstances (e.g., high TSS levels over long periods during dredging operations), but insufficient information is available to make ESA effect determinations. In general, marine mammals are not subject to effects mechanisms that injure fish (e.g., gill clogging, smothering of eggs and larvae), so injury-level effects are unlikely. Behavioral effects, including avoidance or changes in behavior, increased stress, and temporary loss of foraging opportunity, could occur but only at excessive TSS levels (Johnson 2018). Todd et al. (2015) postulated that dredging and related turbidity effects could affect the prey base for marine mammals, but the significance of those effects would be highly dependent on site-specific factors. Small-scale changes from one-time, localized activities are not likely to have significant effects.

Data are not available regarding whales' avoidance of localized turbidity plumes; however, Todd et al. (2015) suggest that since marine mammals often live in turbid waters, significant effects from turbidity are not likely. If elevated turbidity caused any behavioral responses such as avoiding the turbidity zone or changes in foraging behavior, such behaviors would be temporary, and any negative effects would likewise be short term and temporary. Cronin et al. (2017) suggest that NARWs may use vision to find copepod aggregations, particularly if they locate prey concentrations by looking upwards. However, Fasick et al. (2017) indicate that NARWs must rely on other sensory systems (e.g., vibrissae on the snout) to detect dense patches of prey in very dim light (at depths greater than 525 ft [160 m] or at night). These studies indicate that whales, including NARWs, are likely able to forage in low-visibility conditions and, thus, could continue to feed in the elevated turbidity. If turbidity from the proposed activities caused foraging whales to leave the area, there would be an energetic cost of swimming out of the turbid area. However, increases in turbidity from the Proposed Action would be temporary, localized events, and whales could resume foraging behavior once they were outside of the turbidity zone or once the suspended sediment settled out of the water column.

Elevated TSS concentrations are expected to be limited in magnitude, short term in duration, and likely within the range of natural variability. This limited temporal effect over a relatively small area are not expected to interfere with ESA-listed species foraging success. Therefore, effects from increased turbidity are expected to be localized, temporary, non-measurable and **insignificant**. Increased turbidity associated with the Proposed Action **may affect, not likely to adversely affect** ESA-listed marine mammals.

NARWs feed almost exclusively on copepods (**Section 5.1.1.2**). Copepods exhibit diel vertical migration; that is, they migrate downward out of the euphotic zone at dawn, presumably to avoid being eaten by visual predators, and they migrate upward into surface waters at dusk to graze on phytoplankton at night (Baumgartner and Fratantoni 2008; Baumgartner et al. 2011). Baumgartner et al. (2011) conclude that there is considerable variability in this behavior and that it may be related to stratification and presence of phytoplankton prey with some copepods in the Gulf of Maine remaining at the surface and some remaining at depth. Because copepods even at depth are not in contact with the substrate, no burial or loss of copepods is anticipated during any project activity. No scientific literature could be identified that evaluated the effects on marine copepods resulting from exposure to TSS. Based on what is known about effects of TSS on other aquatic life, it is possible that high concentrations of TSS could negatively affect

copepods. However, given that 1) the expected TSS levels are below those that are expected to result in effects on even the most sensitive species evaluated; 2) the sediment plume would be transient and temporary; and 3) elevated TSS plumes would occupy only a miniscule portion of the Action Area at any given time; any effects on copepod availability, distribution, or abundance on foraging whales would be so small that they could not be meaningfully evaluated, measured, or detected and **insignificant**. Therefore, increased turbidity associated with the Proposed Action **may affect, not likely to adversely affect** NARW critical habitat.

6.5.2.2 Sea Turtles

NMFS has concluded that although scientific studies and literature are lacking, the effects of elevated TSS on ESA-listed sea turtles are likely to be similar to the expected effects on marine mammals (Johnson 2018). Physical or lethal effects in increased turbidity during the proposed surveys are unlikely because sea turtles are air-breathing and, therefore, do not share the physiological sensitivities of susceptible organisms like fish and invertebrates. Additionally, only short-term, localized increases in turbidity around the survey activities would be expected to settle quickly due to the nature of these activities.

Elevated TSS may cause individuals to alter normal movements and behaviors (e.g., moving away from an affected area). They may also experience behavioral stressors, like reduced ability to forage and avoid predators; however, turtles are migratory species that forage over wide areas and would likely be able to avoid short-term TSS impacts that are limited in severity and extent without consequence. As a result, these behavioral changes are expected to be limited in extent, short term in duration, and likely too small to be detected (NOAA 2021). Moreover, many sea turtle species routinely forage in nearshore and estuarine environments with periodically high natural turbidity levels. Therefore, short term exposure to elevated suspended sediment levels is unlikely to measurably inhibit foraging (Michel et al. 2013). However, elevated levels of turbidity may negatively affect sea turtle prey items, including benthic mollusks, crustaceans, sponges, and sea pens by clogging respiratory apparatuses. The more mobile prey items like crabs may also be negatively affected by turbidity by clogging their gills but likely to a lesser extent due to their ability to leave the turbid area (BOEM 2021). Only short term, limited impacts to fish and invertebrates are expected from suspended sediments; therefore, secondary effects on sea turtle prey availability are not expected. Any effects from increased turbidity levels from the proposed survey activities on turtles, their habitat, or their prey would be isolated and temporary and are so small that they could not be measured and are, therefore, **insignificant**. Increased turbidity associated with the Proposed Action **may affect, not likely to adversely affect** ESA-listed sea turtles.

6.5.2.3 Marine Fish

Studies of the effects of turbid water on fish suggest that concentrations of suspended solids can reach thousands of milligrams per liter before an acute reaction is expected (Wilber and Clarke 2001). Johnson (2018) recommends that sturgeon should not be exposed to TSS levels of 1,000 milligrams per liter above ambient levels for longer than 14 days at a time to avoid behavioral and physiological effects. Tolerance of juvenile Atlantic sturgeon to suspended sediments has been evaluated in a laboratory setting and exposed individuals to TSS concentrations of 100, 250, and 500 milligrams per liter for a 3-day period (Wilkens et al. 2015). Of the fish exposed, 96 percent survived the test, and the authors suggested that the absence of any significant effects on survival or swimming performance indicates that the impacts of sediment plumes in natural settings are minimal where fish can move or escape. Directed studies of sturgeon TSS tolerance are currently lacking, but sturgeons, as a whole, are adapted to living in naturally turbid environments like large rivers and estuaries (Johnson 2018). Given this, adult and subadult sturgeon expected to occur in the Action Area are likely tolerant of elevated suspended sediment levels.

Increases in TSS can influence the behavior of Atlantic salmon. Robertson et al. (2007) observed avoidance responses in all individuals studied in response to an increase in suspended sediment concentration from 20 to 180 mg/L, and also observed increased foraging behaviors on the sediment floating in the water column as the sediment concentration increased. Studies have also noted that increased turbidity levels can also provide a level of protection from predation for migration salmon (Gregory and Levings 1998; Aldvén et al. 2015). However, the nominal increases in turbidity expected from the Proposed Action would provide minimal protection from predators, and would also result in minimal, if any, changes in behavior. While in the marine environment, the majority of individuals would occur and forage within the pelagic environment, with limited association with the seafloor. Therefore, there would be minimal overlap between the increases in turbidity from the Proposed Action and foraging Atlantic salmon.

Atlantic sturgeon are opportunistic benthivores that feed primarily on mollusks, polychaete worms, amphipods, isopods, shrimps and small bottom-dwelling fishes; therefore, suspended sediment and turbidity could result in some temporary avoidance of turbid areas or feeding challenges. Any effects from elevated level of turbidity from the Proposed Action on Atlantic sturgeon or their prey are considered so small that they could not be measured. Fish would likely depart or avoid unfavorable water quality conditions they may encounter. Suspended sediment and turbidity could result in some temporary avoidance of turbid areas, but the short-term increases in turbidity are expected to result in minor, non-measurable effects. In addition, suspended sediment concentrations during the proposed survey activities would likely be within the range of natural variability for this location. The effects of elevated turbidity on Atlantic sturgeon and Atlantic salmon would be so small that they could not be measured and, therefore, **insignificant**. Increased turbidity associated with the Proposed Action **may affect, not likely to adversely affect** ESA-listed fish.

6.5.3 Presence of Structures

Under the Proposed Action, one FLiDAR buoy would be deployed in the Research Lease Area in a maximum of 620 ft (189 m) water depth between June 2023 and June 2025. The FLiDAR buoy will be moored with a single gravity-based anchor covering a total area of 32 ft² (3 m²). The buoy will be connected to the anchor using chain or synthetic rope kept taut such that it would extend vertically up from the anchor and would not have any loops or slack.

6.5.3.1 Behavioral Changes due to the Presence of Structures

The FLiDAR buoy would present a vertical structure that constitutes an obstacle in the water column that could alter the normal behavior of marine species in the Action Area during the approximate 2-year deployment period.

A single FLiDAR buoy is unlikely to alter the foraging, migrating, or mating behavior of any ESA-listed marine mammal, sea turtle, or fish species given its minimal footprint within the Action Area. Therefore, the potential for effects is **discountable**. Behavioral changes due to the presence of structures under the Proposed Action **may affect, not likely to adversely affect** ESA-listed marine mammals sea turtles, and fish.

6.6 Entanglement

Entanglement is a risk for all ESA-listed marine mammals, sea turtles, and fish. A number of mechanisms are in effect that may increase or alter exposure to entanglement risk, potentially leading to injury or death. Survey activities that use in-water gear would pose an entanglement risk to ESA-listed marine mammals, sea turtles, and fish.

The mooring components associated with the FLiDAR buoy (Section 1.3.1.1) is expected to be under buoyant tension and is not expected to pose an entanglement risk to ESA-listed species. Additionally, PAM for marine mammals, ambient noise, and large pelagic and benthic fish monitoring (Section 1.3.2.9) will use units that are moored and floated approximately 50 ft (15 m) above the seafloor with no surface connection. Given the lack of vertical lines that reach the surface and the buoyant tension that the floated receivers will be under, no entanglement risk is associated with PAM surveys. All other site characterization activities pose no entanglement risk to ESA-listed species due to the survey and equipment types proposed (Section 1.3.2.1 through 1.3.2.11). These survey activities are therefore not considered further in this section.

Survey activities under the Proposed Action that pose an entanglement risk to ESA-listed species include bottom trawl surveys for marine fish and invertebrates (Section 1.3.2.12), plankton and larval lobster surveys (Section 1.3.2.13), lobster trawl surveys (Section 1.3.2.14), and gillnet surveys (Section 1.3.2.15). These four survey activities are analyzed in Section 1.16.1.

6.6.1 Entanglement from Site Characterization Surveys

As discussed in Section 3.1.2, a number of survey activities which use in-water sampling gear will be conducted within the Action Area. These survey activities will result in an increase in the amount of fishing gear in the water, which will therefore result in an increased entanglement risk for ESA-listed species. These surveys will utilize both mobile (i.e., bottom trawl and vertical and neuston net tows) and stationary (i.e., vented and ventless lobster pots, gillnets) gear types, which pose differential risk to the species considered in this BA. However, the Proposed Action-related surveys will be of limited frequency and duration, as summarized in Table 6-11.

Table 6-11. Estimated duration of site characterization survey activities that utilize in-water sampling gear

Activity	Gear Type	Number of Samples/Gear	Survey Period
Bottom trawl surveys for marine fish and invertebrates	Otter trawl with modified shrimp trawl net	Seasonal trawls (number to be determined), totaling 30–38 tows	September 2023 through September 2025 (or until approval of the RAP)
Plankton and larval lobster surveys	Vertical and Neuston net tows	Monthly tows	July 2023 until RAP is approved
Lobster surveys	Vented and ventless lobster pots	Seasonal; trawls (number to be determined) of 12 traps each will be hauled three times per season	September 2023 through September 2025 (or until approval of the RAP)
Gillnet surveys	Gillnet	Seasonal (number to be determined)	September 2023 through September 2025 (or until approval of the RAP)

Source: Draft EA Section 2.2, BOEM 2023a
 RAP = Research Assessment Plan.

The implementation of monitoring and mitigation measures under the Proposed Action (Section 3.3) would help to reduce entanglement or capture risk for ESA-listed species in project-related site characterization surveys. All fisheries monitoring survey plan designs would be required to follow the Fisheries Survey Guidelines (Fisheries Guidelines, updated 27 March 2023; BOEM 2023). The Fisheries Guidelines provides guidance for standardizing survey plan design and aims to reduce the risk of

interactions between protected species and sampling gear by minimizing the amount of gear fished (i.e., set or towed), the gear soak or tow duration, and the spatial and temporal overlap with protected species. In accordance with BOEM's Fisheries Guidelines, best practices for trap, pot, and gillnet gear require that all gear is hauled at least once every 30 days and that all gear is removed and stored on land between sampling seasons; no surface floating buoy lines are used; all groundlines are composed of sinking line; buoy lines use weak links; gillnet strings are anchored with Danforth-style anchor; and knot free buoy lines are used to the extent practicable. Additionally, all gillnet sampling times should be limited to no more than 24 hours, all survey vessels have at least one survey team member on board that has completed the Northeast Fisheries Observer Program observer training or similar, and all vessel using fixed gear must have adequate disentanglement equipment onboard. Application of these measures are considered in the assessment of impact for ESA-listed species in the following subsections. Additional measures that have been identified to contribute to specific impact reductions are discussed for each resource, where applicable.

6.6.1.1 Marine Mammals

Theoretically, any line in the water column, including line resting on or floating above the seafloor set in areas where whales occur could entangle a marine mammal (Hamilton et al. 2019, Johnson et al. 2005). Entanglements may involve the head, flippers, or fluke; effects range from no apparent injury to death. Entanglement in fishing gear has been identified as one of the leading causes of mortality in NARW and may be a limiting factor in the species recovery (NMFS 2023a; Knowlton et al. 2012). Current estimates indicate that 83 percent of NARWs show evidence of at least one past entanglement and 60 percent with 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 was attributed to non-mobile fishing gear (i.e., lobster and gillnet gear) (Knowlton et al. 2012). Additionally, recent literature indicates that the proportion of NARW mortality attributed to fishing gear entanglement is likely higher than previously estimated from recovered carcasses (Pace 2021). Entanglement may also be responsible for high mortality rates in other large whale species, including fin whales (Henry et al. 2020; Read et al. 2006).

As discussed above, large whales are most vulnerable to entanglement in stationary vertical and ground lines associated with trap/pot gear, including buoy lines used for lobster pot sets and gillnets. The Final Environmental Impact Statement, Regulatory Impact Review, and Initial Regulatory Flexibility Analysis for Amending the Atlantic Large Whale Take Reduction Plan (ALWTRP): Risk Reduction Rule (NOAA 2021) provides an analysis of data that shows entanglement in commercial fisheries gear represents the highest proportion of all documented serious and non-serious incidents reported for humpback, North Atlantic right, fin, and minke whales. Entanglement was the leading cause of serious injury and mortality for North Atlantic right, humpback, fin, and minke whales from 2010 to 2018 for cases where the cause of death could be identified (NOAA 2021).

All vertical lines pose an entanglement risk to marine mammals. In accordance with BOEM's Fisheries Guidelines, updated 27 March 2023 (BOEM 2023), the following measures, if fully implemented, will serve to reduce potential entanglement risk to marine mammals:

- Reduce the number of vertical lines: Minimizing the number of vertical lines can reduce entanglement risk to large whales and sea turtles; this can be accomplished by reducing the number of vertical lines used by reducing the number of traps set, trawling up; or use of ropeless gear.
- Avoid deploying this gear type in areas/times where large whales are known to occur.

- To reduce the risk of serious injury and mortality to North Atlantic right whales, ropeless technology or 1,700 pound breaking strength buoy lines should be used for all trap/pot gear. This can be accomplished by using: a) whole buoy line with a breaking strength of 1,700 pound; or b) buoy line with weak inserts that result in the line having an overall breaking strength of 1,700 pound. Specifically, the number and placement of weak inserts should be consistent with the specifications provided by the Atlantic Large Whale Take Reduction Plan. All gear should be removed from the water between survey periods, as well as at the end of each survey season. Additionally, per Atlantic Large Whale Take Reduction Plan regulations, in the Northeast Region, all gear must be hauled out of the water at least once every 30 days.
- All trap/pot gear must in compliance with the ALWTRP Risk Reduction Rule (50 CFR Part 229 Subpart C).

In accordance with 50 CFR Part 229 Subpart C and final modifications to the ALWTRP Risk Reduction Rule (86 FR 51970), sinking groundline minimizes the amount of line that is suspended in the water column, which reduces the potential for entanglement. As discussed in the ALWTRP Risk Reduction Rule, it is believed that the weak links allow the buoy to break away and the rope to pull through the baleen if an entanglement occurs, although it is difficult to assess how well the weak link reduces serious injury and mortality (NOAA 2021). Based upon Knowlton et al. (2018), it is assumed that weak rope (engineered to break at 1,700 pounds or less) would allow whales to break free from the ropes and avoid a life-threatening entanglement (NOAA 2021). The application of these mitigative measures will serve to minimize and reduce entanglement risk to ESA-listed marine mammals.

Under the Proposed Action, lobster trawl surveys will utilize rope-less fishing gear at one end of the set and a regular endline at the other end. Therefore, each lobster pot set (consisting of 12 lobster pots) will have a single vertical buoy line to the surface. Additionally, each gillnet will be set with two endlines to a surface buoy. All vertical lines pose an entanglement risk to marine mammals. Between each lobster pot will be a sinking groundline with weak links in accordance with NOAA (2021) recommendations. Sinking groundline minimizes the amount of line that is suspended in the water column, which reduces the potential for entanglement. As discussed in the ALWTRP Risk Reduction Rule, it is believed that the weak links allow the buoy to break away and the rope to pull through the baleen if an entanglement occurs, although it is difficult to assess how well the weak link reduces serious injury and mortality (NOAA 2021). Based upon Knowlton et al. (2016), it is assumed that weak rope (engineered to break at 1,700 pounds or less) would allow whales to break free from the ropes and avoid a life-threatening entanglement (NOAA 2021). The application of these mitigative measures will serve to minimize and reduce entanglement risk to ESA-listed marine mammals.

NMFS' opinion on the Continued Prosecution of Fisheries and Ecosystem Research Conducted and Funded by the Northeast Fisheries Science Center and the Issuance of a Letter of Authorization under the Marine Mammal Protection Act for the Incidental Take of Marine Mammals pursuant to those Research Activities (dated June 23, 2016), concluded that impacts to NARW, humpback, fin, sei, and blue whales, if any, as a result of trawl gear use would be expected to be extremely unlikely to occur. Under the Proposed Action, 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 2023) 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. Observations during mobile gear use have shown that entanglement or capture of large whale species is extremely rare (NMFS 2016). Therefore, entanglement risk to ESA-listed marine mammals as a result of trawl surveys is considered extremely unlikely.

Neuston sampling is conducted with a plankton net towed at slow speeds (~4 knots) for short periods (~10 minutes) in the top 1.6 feet (0.5 meter) of the water column. The Neuston net frame is typically

small (i.e., 2.4 meters by 0.6 meters [7.8 feet by 1.9 feet]) in size, and the net is made of a fine micrometer mesh. Given the size of the net relative to the body size of ESA-listed marine mammals, no marine mammal entanglement is expected to occur from Neuston net sampling. Vertical net tows are anticipated to use a frame and net similar to that described for the Neuston net, but are pulled vertically through the water column. The risk presented to ESA-listed marine mammals would be the same as that for Neuston net sampling. Therefore, no ESA-listed marine mammal entanglement is expected from plankton and larval lobster surveys net tows.

The contribution of 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 3.2.1.1.8**). The potential for marine mammals to interact with the gear and to become entangled is therefore extremely unlikely given the low probability of a marine mammals encountering Proposed Action related fisheries gear within the Gulf of Maine. Additionally, given the expected limited frequency and duration of project-related sampling surveys and the application of mitigation measures (**Section 3.3**), marine mammal entanglement and entrapment highly unlikely and the risk is considered **discountable**. Mobile and stationary gear utilization as part of the Proposed Action sampling surveys **may affect, not likely to adversely affect** ESA-listed marine mammals.

The only sampling gear that has the potential to affect NARW critical habitat is the plankton and larval lobster surveys net tows by capture of preferred NARW prey (*C. finmarchicus*). However, given the limited duration and extent of planktonic sampling associated with the Proposed Action, removal or dispersal of *C. finmarchicus* is expected to be so small that it cannot be meaningfully measured, evaluated, or detected. Any effects to NARW critical habitat PBFs are thus considered **insignificant**. Therefore, the Proposed Action sampling surveys **may affect, not likely to adversely affect** NARW critical habitat.

6.6.1.2 Sea Turtles

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, including both mobile (i.e., trawl) and stationary (i.e., pots).

The capture and mortality of sea turtles in bottom trawl fisheries is well documented (Henwood and Stuntz 1987; NMFS and USFWS 1991; NMFS and USFWS 1992; NMFS and USFWS 2008; NRC 1990). NOAA has prioritized reduction of sea turtle interactions with fisheries where these species occur. Finkbeiner et al. (2011) compiled sea turtle bycatch in U.S. fisheries and found that in the Atlantic, a mean estimate of 137,700 interactions, of which 4,500 were lethal, occurred annually since the implementation of bycatch mitigation measures; however, a vast majority of the interactions (98 percent) and mortalities (80 percent) occurred in the Southeast/Gulf of Mexico shrimp trawl fishery, although sampling inconsistencies and limitations should be considered when interpreting this data (NMFS 2014b). While sea turtles are capable of remaining submerged for long periods of time, they appear to rapidly consume oxygen stores when entangled and forcibly submerged in fishing gear (Lutcavage and Lutz 1997). Incidentally captured individuals would most likely suffer stress and potential injury. However, the preponderance of available research (Epperly et al. 2002; Sasso and Epperly 2006) and anecdotal information from past trawl surveys indicates that limiting tow times to less than 30 minutes would likely eliminate the risk of death for incidentally captured sea turtles. The proposed trawls would be limited to 20 minutes of tow time in accordance with BOEM's Fisheries Guidelines (BOEM 2023). The relatively short tow duration is expected to minimize the potential for interactions with sea turtles and

pose a negligible risk of mortality. The proposed mitigation measures outlined in Sections 3.3.7 and 3.3.10 would be expected to minimize the risk of serious injury and mortality from forced submergence for sea turtles caught in the bottom otter trawl survey gear. Where possible, turtles are disentangled and, if injured, may be brought back to rehabilitation facilities for treatment and recovery. This helps to reduce the rate of death from entanglement. Incidental capture and entanglement of sea turtles would likely continue in the Action Area at a similar rate over the life of the Proposed Action. Safe release, disentanglement protocols, and rehabilitation would help to reduce the severity of impacts of these interactions, and these efforts are also expected to continue over the life of the proposed Project.

Stationary gear poses a risk of entanglement for ESA-listed sea turtle species due to buoy and anchor lines. Of all the ESA-listed sea turtles included in this assessment, the leatherback seems to be the most vulnerable to entanglement in trap/pot fishing gear, possibly due to its physical characteristics, diving and foraging behaviors; distributional overlap with the gear; and the potential attraction to prey items that collect on buoys and buoy lines at or near the surface (NMFS 2016). Individuals entangled in pot gear generally have a reduced ability to forage, dive, surface, breathe, or perform other behaviors essential for survival (Balazs 1985). In addition to mortality, gear entanglement can restrict blood flow to extremities and result in tissue necrosis and death from infection. Individuals that survive may lose limbs or limb function, decreasing their ability to avoid predators and vessel strikes (NMFS 2016). In the event of a sea turtle capture, survey vessels would be required to carry adequate disentanglement equipment and crew trained in proper handling and disentanglement procedures (**Section 3.3.10.6**).

All sea turtle species are susceptible to incidental capture and entanglement in gillnet fishing gear, which can result in mortality (Moore et al. 2009). Accidental capture resulting in the death of an individual, if it were to occur, would be considered a take. Since few details regarding the gillnet survey plan are available at this time (see **Section 3.1.2.15**), this risk cannot be fully ruled out or eliminated. Therefore, sea turtle entanglement resulting in mortality may occur as a result of gillnet fishery sampling under the Proposed Action.

As discussed previously, neuston sampling is typically conducted with a plankton net towed at slow speeds for short periods in the top portion of the water column using a small frame and fine micrometer mesh net. Although capture is possible, given the relatively small size of the net, the use of trained observers onboard, and the limited tow length duration, no sea turtle entanglement is expected to occur from Neuston net sampling. Vertical net tows are anticipated to use a frame and net similar to that described for the Neuston net, but are pulled vertically through the water column. The risk presented to sea turtles would be the same as that for Neuston net sampling. Therefore, entanglement risk due to the methodology presented for plankton and larval lobster surveys net tows is extremely unlikely for sea turtles.

Proposed Action-related sampling surveys will be of limited frequency and duration, and 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 3.2.1.1.8**). The potential for sea turtles to interact with the gear and to become entangled is therefore unlikely given the low probability of a sea turtle encountering Proposed Action related gear within the Gulf of Maine. Green, loggerhead, and Kemp's ridley sea turtles may be captured during trawl surveys, and capture would cause stress and may result in injury, and in rare cases, post capture mortality. While Leatherback turtles are less likely to be captured during trawl surveys, they are at a heightened risk to entanglement in trap and pot gear. All sea turtle species are susceptible to incidental capture resulting in mortality in gillnet sampling gear. As discussed in **Section 5.1.2**, sea turtle presence in the Action Area is relatively low. However, even though sampling efforts will be of limited extent and duration, and the implementation of mitigation measures (**Section 3.3**) will likely reduce the entanglement risk to sea turtles, impacts from sampling surveys under the Proposed Action cannot be discounted given the possibility of take resulting primarily from gillnet

surveys. Because of this, entanglement in sampling gear under the Proposed Action **may affect, likely to adversely affect** ESA-listed sea turtles.

6.6.1.3 Marine Fish

Atlantic sturgeon are susceptible to capture in trawl nets, which may result in injury or death. Non-lethal effects could include reduced fecundity and delayed or aborted spawning migrations (Collins et al. 2000; Moser et al. 2000; Moser and Ross 1995). Northeast Fisheries Observer Program data from Miller and Shepard (2011) indicate that mortality rates of Atlantic sturgeon caught in otter trawl gear is approximately 5 percent. Negative impacts on sturgeon resulting from trawling capture are related to tow speed and duration (Moser et al. 2000). The risk to the species is greatest where high fishing efforts occur in regions with high Atlantic sturgeon abundances. However, the use of trawl gear has been employed as a safe and reliable method to capture sturgeon, provided that the tow time is limited (NMFS 2014). The relatively short tow duration (≤ 20 minutes, in accordance with BOEM's Fisheries Guidelines [BOEM 2023]) is expected to minimize the potential for interactions with Atlantic sturgeon and pose a negligible risk of mortality. Furthermore, in the event of an Atlantic sturgeon capture, survey vessels would be required to carry adequate disentanglement equipment and crew trained in proper handling and disentanglement procedures to reduce potential mortality. Atlantic salmon predominantly face risk of incidental capture in recreational angling in freshwater habitats in the Gulf of Maine (which is not included under the Proposed Action) (NMFS and USFWS 2020b), but Atlantic salmon may also be captured in bottom trawl gear during their transits to or from their feeding grounds in the North Atlantic or while on their feeding grounds (NMFS and USFWS 2019). Similar to that for Atlantic sturgeon described above, the relatively short tow duration (≤ 20 minutes) is expected to minimize the potential for interactions with Atlantic salmon and pose a low risk of capture and mortality.

Stationary pots that are baited and pose a potential risk to Atlantic sturgeon and Atlantic salmon. However, fish traps and pots were not recorded as potential sources for capture of Atlantic sturgeon in the Northeast Fisheries Observer Program data (Dunton et al. 2015) and it is unlikely that either species would become entangled in the lines or pots. An analysis of salmon bycatch data from Pacific groundfish fisheries indicate nearly all (>99%) bycatch results from trawl fisheries, suggesting very little, if any, bycatch is attributable to tap/pot type gear (Witherell et al. 2002). While this study analyzed data outside of the Action Area, the results are interpreted to indicate similar (i.e., low) entrapment risk for Atlantic salmon due to trap and pot gear types associated with the Proposed Action.

Both Atlantic sturgeon and Atlantic salmon are susceptible to incidental capture and entanglement in gillnet fishing gear, which can result in mortality (Stein et al. 2004; Sheehan et al. 2012). Accidental capture resulting in the death of an individual, if it were to occur, would be considered a take. Since few details regarding the gillnet survey plan are available at this time (see **Section 3.1.2.15**), this risk cannot be fully ruled out or eliminated. Therefore, ESA-listed fish entanglement resulting in mortality may occur as a result of gillnet fishery sampling under the Proposed Action.

As discussed previously, neuston sampling is typically conducted with a plankton net towed at slow speeds for short periods in the top portion of the water column using a small frame and fine micrometer mesh net. Although capture is theoretically possible during Neuston net sampling, given the relatively small size of the net, the limited tow length duration, and the low rate of surface behaviors exhibited by Atlantic sturgeon or Atlantic salmon, no ESA-listed fish entanglement is expected to occur. Vertical net tows are anticipated to use a frame and net similar to that described for the Neuston net, but are pulled vertically through the water column. The risk presented to ESA-listed fish would be the same as that for Neuston net sampling. Therefore, entanglement risk due to the methodology presented for plankton and larval lobster surveys net tows is extremely unlikely for ESA-listed fish.

Similar to that described for sea turtles, a number of monitoring and mitigation measures are designed to standardize Atlantic sturgeon handling and reporting procedures in response to an entanglement (**Section 3.3.9.6**). These measures will reduce impact to Atlantic sturgeon by ensuring that the handling of any sturgeon caught in fisheries sampling gear will not cause or exacerbate any direct injury to the animal. Sufficient training and proper technique will also reduce impacts to captured sturgeon by minimizing the time of handling and, therefore, the individuals' stress (Beardsall et al. 2013; Bartholomew and Bohnsack, 2005).

While entanglement or capture of Atlantic sturgeon and Atlantic salmon in the proposed survey gear is unlikely given the limited extent and short duration of Project-related fisheries monitoring surveys and the application of mitigation measures (**Section 3.3.9**), incidental capture resulting in mortality may still result. Impacts to ESA-listed fish from sampling surveys under the Proposed Action therefore cannot be discounted. Because of this, entanglement in sampling gear under the Proposed Action **may affect, likely to adversely affect** ESA-listed fish.

6.7 Air Emissions

It is expected that the vessels and equipment used during the site assessment and site characterization surveys would generate emissions that could affect air quality within the marine component of the Action Area. Most emissions would likely result from the proposed vessel activities in the Action Area.

At this time, there is no information on the effects of air quality on ESA-listed marine mammal and sea turtle species that may occur in the marine component of the Action Area. Marine mammal and sea turtle exposures to air pollutant emissions during the proposed surveys are anticipated to be temporary and short term in duration. Given the fact that vessel exhausts are located high above the water surface, and most vessel activity will occur in the open ocean where exhaust will be readily dispersed by winds, the likelihood of individual animals being repeatedly exposed to high concentrations of airborne pollutants from vessels is extremely low, and changes in concentration at the water surface level are expected to be so small that they cannot be meaningfully measured.

On this basis, it is reasonable to conclude that any effects to ESA-listed marine mammals and sea turtles from these emissions will be so small that they cannot be meaningfully measured, detected, or evaluated and, therefore, are **insignificant**. Air emissions resulting from the Proposed Action **may affect, not likely to adversely affect** ESA-listed marine mammals and sea turtles. Atlantic sturgeon and Atlantic salmon would not be exposed to airborne emissions, therefore this stressor would have **no effect** on ESA-listed fish.

6.8 Lighting

The Proposed Action would introduce mobile and stationary artificial light sources to the Action Area that would persist from dusk to dawn. Vessels would have deck and safety lighting, producing artificial light throughout the duration of the Proposed Action. The FLiDAR buoy may also have lighting on the top-side structure, though this would likely only affect a limited area around the buoy.

Artificial light has been shown to alter the invertebrate epifauna and fish community composition and abundance in proximity to human-made structures (Davies et al. 2015; McConnell et al. 2010; Nightingale et al. 2006). Artificial lighting may disrupt the diel migration (vertical distribution) of some prey species, including zooplankton, which may secondarily influence marine mammal distribution patterns (Orr et al. 2013). Observations at offshore oil rigs showed dolphin species foraging near the surface and staying for longer periods of time around platforms that were lit (Cremer et al. 2009). Artificial light in coastal environments is an established stressor for juvenile sea turtles, which use light to

aid in navigation and dispersal and can become disoriented when exposed to artificial lighting sources, but the significance of artificial light in offshore environments is less clear (Gless et al. 2008). Finfish impacts due to artificial light are highly species dependent and can either cause attraction or avoidance (Orr et al. 2013).

Collectively, these findings suggest the potential for effects on ESA-listed marine mammal, sea turtle, and fish species as a result of artificial lighting. Overall, these effects would be localized and limited to the area exposed to operational lights from the vessels and FLiDAR buoy. Orr et al. (2013) indicate that lights on offshore structures that flash intermittently for navigation or safety purposes and do not present a continuous light source. Limpus (2006) suggested that intermittent flashing lights with a very short “on” pulse and long “off” interval are non-disruptive to marine turtle behavior, irrespective of the color. Similarly, navigation and anchor lights on top of vessel masts are unlikely to adversely affect sea turtles (Limpus 2006). Atlantic sturgeon and Atlantic salmon are demersal species and are unlikely to encounter the minimal lighting generated by the Proposed Action.

Orr et al. (2013) summarized available research on potential operational lighting effects from offshore structures and concluded that the operational lighting effects on marine mammal, marine turtle, and fish distribution, behavior, and habitat use were unknown but likely negligible when recommended design and operating practices are implemented. Specifically, using low-intensity shielded directional lighting on structures, activating work lights only when needed, and using red navigation lights with low strobe frequency would reduce the amount of detectable light reaching the water surface to negligible levels.

Based on the available information, effects of lighting of vessels and the FLiDAR buoy on ESA-listed marine mammals, sea turtles, and fish leading to changes in behavior and alterations in prey distribution would be too small to be meaningfully measured or detected and, therefore, **insignificant**. Given the small scale of effects, the effects of lighting associated with the Proposed Action **may affect, not likely to adversely affect** ESA-listed marine mammals, sea turtles, and fish.

6.9 Non-Routine Events

In this section, BOEM considers the “low probability events” that were identified by BOEM in the Draft EA (Section 2.2.2). These events, while not part of the Proposed Action, include storms, allisions and collisions, spills, and recovery of lost survey equipment.

6.9.1 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 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.

Storms in the Action Area resulting in potential structural failures of the FLiDAR buoy are not likely to effect ESA-listed marine mammals, sea turtles, or fish, and therefore **no effect** is expected for any species.

6.9.2 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, traffic separation schemes, and anchorages for vessels transiting into and out of the ports of Maine and the other New England states. Risk of allisions with FLiDAR buoys 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 traffic separation scheme (**Figure 6-1**), BOEM will consider issuance of no more than one lease within the Research Lease Area, and that lease will neither exceed 10,000 acres (40 km²) nor support more than 12 floating wind turbine generators. BOEM also expanded the 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 traffic separation schemes.

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.

Allisions and collisions of vessels and aircrafts under the Proposed Action with the FLiDAR buoy are not likely to affect ESA-listed marine mammals, sea turtles, or fish, and therefore **no effect** is expected for any species.

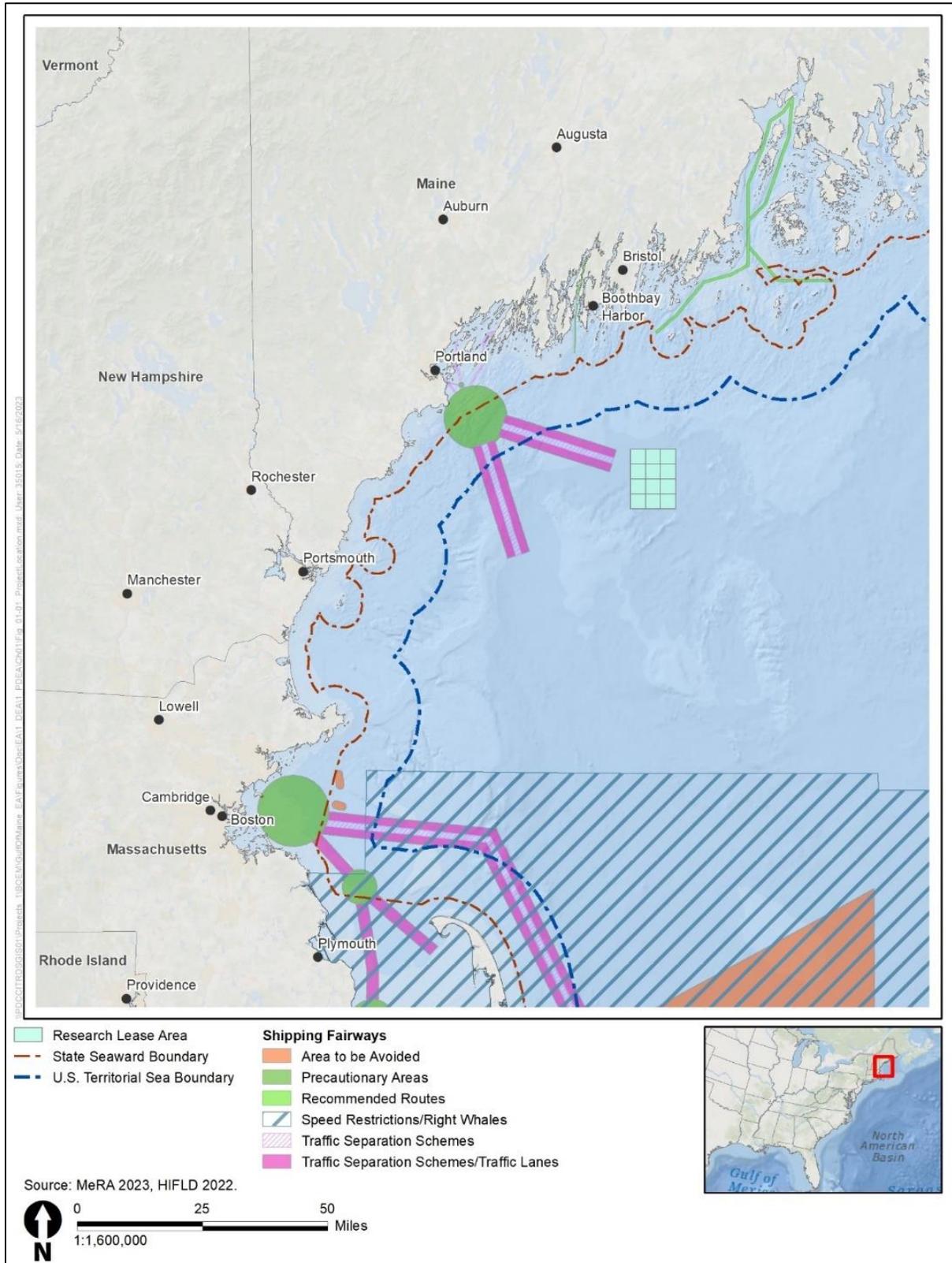


Figure 6-1. Location of the traffic separation schemes and traffic lanes in the Action Area

6.9.3 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.

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., Pierce et al., 2008; Jepson et al., 2016; Hall et al., 2018; Murphy et al., 2018). All vessels would be expected to comply with USCG requirements relating to prevention and control of oil and fuel spills. Any spills associated with the Proposed Action would be an isolated event with rapid dissipation; impacts on marine mammals would be unlikely to occur and therefore **discountable**. Effects of spills under the Proposed Action therefore may affect, not likely to adversely affect ESA-listed marine mammals.

Similar to marine mammals, sea turtles are also 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., Pierce et al., 2008; Jepson et al., 2016; Hall et al., 2018; Murphy et al., 2018). All vessels would be expected to comply with USCG requirements relating to prevention and control of oil and fuel spills. Any spills associated with the Proposed Action would be an isolated event with rapid dissipation; impacts on sea turtles would be unlikely to occur and therefore **discountable**. Effects of spills under the Proposed Action therefore may affect, not likely to adversely affect ESA-listed sea turtles.

Exposure to aquatic contaminants or inhalation of fumes from oil spills can result in mortality or sublethal effects on the affected ESA-listed fish, including adrenal effects, hematological effects, liver effects, lung disease, poor body condition, skin lesions, and several other health affects attributed to oil exposure (Mohr et al. 2008; Sullivan et al. 2019; Takeshita et al. 2017). All vessels would be expected to comply with USCG requirements relating to prevention and control of oil and fuel spills. Any spills associated with the Proposed Action would be an isolated event with rapid dissipation; impacts on Atlantic sturgeon

or Atlantic salmon would be unlikely to occur and therefore **discountable**. Effects of spills under the Proposed Action therefore may affect, not likely to adversely affect ESA-listed fish.

Similarly, proposed Project vessels transiting within NARW critical habitat may present a risk of accidental releases or spills. However, all Project-related vessels would follow all applicable guidelines such as those recommended by the International Convention for the Prevention of Pollution from Ships to minimize releases. Therefore, the likelihood of releases from proposed Project vessels that would alter the quality of NARW critical habitat is **discountable**.

Water quality effects resulting from activities under the Proposed Action **may affect, not likely to adversely affect** ESA-listed marine mammals, sea turtles, fish, and NARW critical habitat.

6.9.4 Recovery of Lost Survey Equipment

Equipment used during site assessment and site characterization activities could be accidentally lost during survey operations. Additionally, it is possible (though unlikely) that the FLiDAR buoy could disconnect from its anchor. In the event of lost equipment, recovery operations may be undertaken to retrieve the equipment. Recovery operations may be performed in a variety of ways depending on the equipment lost. A commonly used method for retrieval of lost equipment that is 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 will drag all the components along the seafloor until recovery.

Marine debris, such as lost survey equipment, that cannot be retrieved because it is either small or buoyant enough to be carried away by currents or is completely or partially embedded in the seafloor (for example, a broken vibracore rod) could create a potential hazard for bottom-tending fishing gear or cause additional bottom disturbance. A broken vibracore rod that cannot be retrieved may need to be cut and capped 1 to 2 m below the seafloor. For marine debris unable to be recovered within 48 hours, BOEM will work with the operator to develop a recovery plan as specified in **Appendix A** developed through BOEM's programmatic ESA consultation with NMFS for data collection activities (BOEM 2023b). Selection of a mitigation strategy would depend on the nature of the lost equipment, and further consultation may be necessary.

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

The recovery of lost equipment could affect marine mammals through additional vessel traffic and noise and the potential impact from entanglement stemming from the dragging of grapnel lines. Traffic and noise associated with non-routine activities likely would be from a single vessel and therefore **discountable**. The extent of impacts from the grapnel lines would be dependent upon the type of lost equipment, which would dictate the number of attempts made at recovery. Regardless, the potential for marine mammals to interact with the grapnel line and to become entangled is extremely unlikely given the low probability of a marine mammal encountering the line within the Action Area; therefore, impacts are expected to be **discountable**. Effects of recovery of lost survey equipment under the Proposed Action therefore may affect, not likely to adversely affect ESA-listed marine mammals.

The recovery of lost equipment could affect sea turtles through additional vessel traffic and noise and entanglement risk related to the dragging of grapnel lines. However, traffic and noise associated with non-routine activities would likely be from a single vessel and therefore be **discountable**. The extent of impacts from the grapnel lines would be dependent upon the type of lost equipment, which would dictate the number of attempts made at recovery. Regardless, the potential for sea turtles to interact with the grapnel line and to become entangled is extremely unlikely given the low probability of a sea turtle encountering the line within the Action Area; therefore, impacts are expected to be **discountable**. Effects of recovery of lost survey equipment under the Proposed Action therefore may affect, not likely to adversely affect ESA-listed sea turtles.

The extent of impacts on ESA-listed fish would depend on the type of lost equipment and if it can be recovered. 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. 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. However, the entanglement risk in grapnel lines is likely so low that it is non-measurable for both Atlantic sturgeon and Atlantic salmon. Similarly, any benthic disturbance would likely be extremely minimal and have very little, if any, effect on ESA-listed fish. The impacts resulting from the recovery of lost equipment are unlikely to occur for Atlantic salmon and would be **discountable**; impacts would not be expected to be meaningfully measured, detected, or evaluated for Atlantic sturgeon and would be **insignificant**. Effects of recovery of lost survey equipment under the Proposed Action therefore **may affect, not likely to adversely affect** ESA-listed fish.

7 Effects of the Action on the Critical Habitat

Given the overlap between NARW critical habitat for the Gulf of Maine foraging habitat Unit 1 (**Section 5.2.1**) and the Action Area, all Project-related vessels and survey activities would operate entirely within designated NARW critical habitat. As discussed above, the number of proposed Project-related vessels is considered relatively low when compared to the existing high levels of commercial and recreational vessel traffic in the region. Vessel transits through Unit 1 as a result of the Proposed Action would not affect or modify the biological or physical oceanographic conditions associated with foraging area functions (i.e., the distribution and aggregations of *C. finmarchicus*). Additionally, all aforementioned monitoring and vessel strike avoidance measures would continue to be implemented. As a precaution, and required by federal regulations, all vessels must maintain 1,640 ft (500 m) or greater from any sighted NARW (**Section 3.3**). Compliance with this measure aids in ensuring no adverse effects on the ability of whales to select an area with the co-occurrence of these features. It is not anticipated that any proposed Project-related vessel transits or Project activities would disrupt NARW feeding behaviors or foraging resources to any appreciable or measurable level given the low frequency of these transits over the total activity period under the Proposed Action. Given this, proposed Project-related vessel transits would have an **insignificant** effect on NARW critical habitat. Therefore, the effects of Project-related vessel traffic **may affect, not likely to adversely affect** NARW critical habitat.

8 Summary of Effects Determinations and Conclusion

Table 8-1 summarizes the effects determinations for ESA-listed marine mammals, sea turtles, and fish species considered in this BA. The following three effects determinations were made:

1. A **may affect, not likely to adversely affect** determination was made when the Project stressors were determined to be **insignificant** or **discountable**.
2. Insignificant: Effects relate to the size or severity of the effect and include effects that are undetectable, not measurable, or so minor they cannot be meaningfully evaluated. Insignificant is the appropriate effects conclusion when plausible effects are going to happen but will not rise to the level of constituting an adverse effect.
 - a. **Discountable:** Effects that are extremely unlikely to occur. For an effect to be discountable, there must be a plausible adverse effect (i.e., a credible effect that could result from the action and would be an adverse effect if it affected an ESA-listed species), but it is extremely unlikely to occur (NMFS and USFWS 1998).⁶
3. If the Project could result in beneficial effects on ESA-listed species (e.g., the aggregation of prey due to structures), but was also likely to cause some adverse effects, then a determination of **may affect, likely to adversely affect** was made.
4. A **may affect, likely to adversely affect** determination was also made when a project stressor could not be fully mitigated and was expected to result in an adverse effect on an ESA-listed species that could result in an ESA-level take.

⁶ When the terms “discountable” or “discountable effects” appear in this document, they refer to potential effects that are found to support a “not likely to adversely affect” conclusion because they are extremely unlikely to occur. The use of these terms should not be interpreted as having any meaning inconsistent with the ESA regulatory definition of “effects of the action.”

Table 8-1. Effects determinations by stressor and species, critical habitat for effects from the Proposed Action

Stressor		Marine Mammals				Sea Turtles				Marine Fish		Critical Habitat
		Fin Whale	North Atlantic Right Whale	Sei Whale	Sperm Whale	Green Sea Turtle (North Atlantic DPS)	Leatherback Sea Turtle	Loggerhead Sea Turtle (Northwest Atlantic DPS)	Kemp's Ridley Sea Turtle	Atlantic Sturgeon	Atlantic Salmon	NARW Unit 1
Underwater Noise	HRG Survey Noise	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA
	Geotechnical Sampling Noise	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA
	Vessel Noise	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA
Habitat Disturbance	Temporary Seafloor Disturbances	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NE
	Turbidity	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA
	Behavioral Changes due to the Presence of Structures	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NE
	Entanglement	NLAA	NLAA	NLAA	NLAA	LAA	LAA	LAA	LAA	LAA	LAA	NLAA
	Air Emissions	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NE
	Lighting	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NE
Non-Routine Events	Storms	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
	Allisions and Collisions	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
	Spills	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA
	Recovery of Lost Survey Equipment	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NE
	Overall Effects Determination	NLAA	NLAA	NLAA	NLAA	LAA	LAA	LAA	LAA	LAA	LAA	NLAA

DPS = distinct population segment; HRG = high-resolution geophysical; LAA = likely to adversely affect; NARW = North Atlantic right whale; NE = no effect; NLAA = not likely to adversely affect

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Appendix A Project Design Criteria for Offshore Wind Data Collection Activities. (Revised February 2023)

Project design criteria (PDCs) and best management practices (BMPs) were developed through programmatic consultation under section 7 of the Endangered Species Act (ESA) regarding *Data Collection and Site Survey Activities for Renewable Energy on the Atlantic Outer Continental Shelf*. The programmatic consultation considers geophysical and geotechnical surveys and the deployment, operation, and retrieval of environmental data collection buoys along the U.S. Atlantic coast associated with the North Atlantic Planning Area, Mid-Atlantic Planning Area, and South Atlantic Planning Area. The PDCs and BMPs will be implemented to the extent permissible by the regulatory authorities of the co-action agencies to which these conditions may apply under the programmatic consultation.⁷

Definitions

1. Definition of “Slow Zone”: The term “Slow Zone” are a program that notifies vessel operators of areas where maintaining speeds of 10 knots or less can help protect right whales from vessel collisions. Under this program, NMFS provides maps and coordinates to vessel operators indicating areas where right whales have been detected. Mariners are encouraged to avoid these areas or reduce speeds to 10 knots or less while transiting through these areas for a defined period. Right Whale Slow Zones are established around areas where right whales have been recently seen or heard; these areas are identical to Dynamic Management Areas (DMA) when triggered by right whale visual sightings.
2. Definition of "Dynamic Management Area (DMA)": The term "DMA" refers to a temporary area designated by NMFS based on visual sightings documenting the presence of three or more right whales within a discrete area (73 FR 60173; December 9, 2008). Mariners are encouraged to avoid these areas or reduce speeds to 10 knots or less while transiting through these areas.
3. Seasonal Management Area (SMA): SMAs refer to areas where vessels 65 feet (19.8 meters) or longer must travel at **10 knots or less** at certain times of the year to reduce the threat of vessel collisions with [North Atlantic right whales](#).
4. Definition of “ESA-Listed Species”: The term ESA-listed species means any threatened or endangered species (i.e., marine mammal, sea turtle, fish, or coral) listed by the National Marine Fisheries Service under the Endangered Species Act of 1973, as amended.
5. Definition of “Geophysical Survey”: The term geophysical survey means the deployment of devices including any boomers, sparkers, bubble guns, or Chirp sub-bottom profilers that produce noise to record geophysical data to which the Project Design Criteria apply during the operation of these sound sources.
6. Definition of “Geotechnical Survey”: The term "geotechnical survey" is used to collectively refer to any physical testing or sampling of the surface or sub-surface of the seafloor.
7. Definition of “Large Whale”: The term “large whale” means baleen whales (North Atlantic right whales, fin whales, sei whales, blue whales, humpback whales, and minke whales); sperm whales; and any unidentified whale.
8. Definition of “Live Bottom Features”: The term “live bottom features” means all sensitive live bottom habitats including submerged aquatic vegetation deep/cold-water coral reefs, and shallow/mesophotic reefs.

⁷ BOEM has regulatory authority for those actions occurring within these areas between the seaward extent of the States' jurisdiction and the seaward extent of Federal jurisdiction of the Outer Continental Shelf (OCS).

9. Definition of “Marine Debris”: The term “marine debris” means any object or fragment of wood, metal, glass, rubber, plastic, cloth, paper, or any other man-made item or material that is lost or discarded in the marine environment.
10. Definition of “Protected Species”: The term “protected species” means all threatened and endangered marine species listed under the Endangered Species Act and all marine mammals protected under the Marine Mammal Protection Act.
11. Definition of “Small Cetacean”: The term small cetacean refers to any species of dolphin in the family *Delphinidae* and harbor porpoises in the family *Phocoenidae*.
12. Definition of “Small Delphinid”: The term small delphinid refers to any species of dolphin of the following genera: *Delphinus*, *Lagenorhynchus*, *Stenella*, and *Tursiops*.
13. Definition of “Clearance Zone”: The term “Clearance Zone” means the area around the sound source that must be cleared of protected species before the activity begins.
14. Definition of “Shutdown Zone”: The term “Shutdown Zone” means the area to be monitored for shutdown. If a protected species is detected within or entering this zone, the lead Protected Species Observer (PSO) would call for an activity shutdown.
15. Definition of "Ramp-up": The term "ramp-up" means the process of incrementally increasing the acoustic source level of the survey equipment when conducting geophysical surveys until it reaches the operational setting.

Summary of Project Design Criteria for actions covered under this Biological Assessment

PDC	Applicable to	Purpose
Avoid Live Bottom Features	Employees and all at-sea contract personnel and vessels	To provide protection to corals, live-bottom habitats, and areas important to threatened or endangered species to reduce the risk of adverse effects to discountable levels.
Avoid Spawning and Developmental Habitat of Sturgeon	Vessel operations and benthic survey activities	To protect spawning and rearing areas within freshwater reaches of shortnose and Atlantic sturgeon habitats.
Marine Debris Awareness and Elimination	All at-sea and dockside operations	To provide informational training to all employees and contract personnel on the proper storage and disposal practices at-sea to reduce the likelihood of accidental discharge of marine debris that can impact protected species through entanglement or incidental ingestion.
Minimize Interactions with Listed Species during Site Characterization Survey Operations	Any survey vessel operating high-resolution geophysical survey equipment to obtain data associated with a lease and operating such equipment at or below 35 kHz for baleen whales, and at or below 160 kHz for sperm whales.	This PDC will avoid injury of ESA-listed species and minimize the likelihood of adverse effects associated with potential disturbance to discountable levels through the establishment of clearance, shutdown zones, shut-downs, PSO monitoring, and other BMPs to avoid and reduce exposure of ESA-listed species to underwater survey noise. In addition to general BMPs, geographic-specific conditions also apply to Cape Cod Bay and Southern Critical Habitat for NARWs.

PDC	Applicable to	Purpose
Minimize Vessel Interactions with Listed Species	All vessels	To avoid injuring or disturbing ESA-listed species by establishing minimum separation distances between vessels and marine protected species; operational protocols for vessels when animals are sighted; to establish sightings awareness for NARWs; and require vessel speed limits in Seasonal Management Areas and Slow Zones/Dynamic Management Areas to avoid injury or death to NARWs.
Entanglement Avoidance	Mooring and anchoring systems for buoys and metocean data collection devices.	To use the best available mooring systems using anchors, chain, cable, or coated rope systems that prevent or reduce to discountable levels any potential entanglement or entrainment of marine mammals and sea turtles.
Protected Species Observers	Geophysical surveys and vessel operations	To require PSO training; to require PSO approval requirements by NMFS prior to deployment on a project.
Reporting Requirements	PSOs and any project-related personnel who observe a dead and/or injured protected species.	To document and record monitoring requirements for geophysical surveys, project-related incidents involving listed species, and to report any impacts to protected species in a project area whether or not the impact is related to the project.

Any activity being carried out under this programmatic consultation must meet the requirements specified below, except when complying with these requirements would put the safety of the vessel or crew at risk.

PDC: Avoid Live Bottom Features

BMP:

All vessel anchoring and any seafloor-sampling activities are restricted from seafloor areas with deep/cold-water coral reefs and shallow/mesophotic reefs. All vessel anchoring and seafloor sampling must also occur at least 150 m from any known locations of threatened or endangered coral species. All sensitive live bottom habitats (eelgrass, cold-water corals, etc.) should be avoided as practicable. All vessels in coastal waters will operate in a manner to minimize propeller wash and seafloor disturbance and transiting vessels should follow deep-water routes (e.g., marked channels), as practicable, to reduce disturbance to sturgeon and sawfish habitat.

PDC: Avoid Seasonal Spawning and Developmental Habitat of Sturgeon

BMP:

1. No geotechnical or bottom disturbing activities will take place during the spawning/rearing season within freshwater reaches of rivers where Atlantic or shortnose sturgeon spawning occurs. Any survey plan that includes geotechnical or other benthic sampling activities in freshwater reaches (salinity 0-0.5 ppt) of such rivers will identify a time of year restriction that will avoid such activities during the time of year when Atlantic sturgeon spawning and rearing of early life stages occurs in that river. Time of year restrictions include the following:

River	No Work Window	Area Affected
Hudson	April – July	Upstream of Newburgh, NY - Beacon Bridge/Rt 84
Delaware	April – July	Upstream of the Delaware Memorial Bridge

PDC: Marine Debris Awareness and Prevention

BMPs:

1. **Training.** Ensure that vessel operators, employees, and contractors engaged in offshore activities pursuant to a lease complete marine trash and debris awareness training annually. The training consists of two parts: (1) viewing a marine trash and debris training video or slide show (described below); and (2) receiving an explanation from management personnel that emphasizes their commitment to the requirements. The marine trash and debris training videos, training slide packs, and other marine debris related educational material may be obtained at <https://www.bsee.gov/debris> or by contacting BSEE at marinedebris@bsee.gov. The training videos, slides, and related material may be downloaded directly from the website. Operators engaged in marine survey activities must continue to develop and use a marine trash and debris awareness training and certification process that reasonably assures that their employees and contractors are in fact trained. The training process must include the following elements:
 - Viewing of either a video or slide show by the personnel specified above;
 - An explanation from management personnel that emphasizes their commitment to the requirements;
 - Attendance measures (initial and annual); and
 - Recordkeeping and the availability of records for inspection by the Department of the Interior (DOI).
2. **Training Compliance Report.** By January 31 of each year, the Lessee must submit to DOI an annual report signed by the Lessee that describes its marine trash and debris awareness training process and certifies that the training process has been followed for the previous calendar year. Reports must be sent via email to renewable_reporting@boem.gov and to marinedebris@bsee.gov.
3. **Marking.** Materials, equipment, tools, containers, and other items used in OCS activities, which are of such shape or configuration that they are likely to snag or damage fishing devices, and could be lost or discarded overboard, must be clearly marked with the vessel or facility identification and properly secured to prevent loss overboard. All markings must clearly identify the owner and must be durable enough to resist the effects of the environmental conditions to which they may be exposed.
4. **Recovery and Prevention.** Recover marine trash and debris that is lost or discarded in the marine environment while performing OCS activities when such incident is likely to: (a) cause undue harm or damage to natural resources, including their physical, atmospheric, and biological components, with particular attention to marine trash or debris that could entangle or be ingested by marine protected species; or (b) significantly interfere with OCS uses (e.g., because the marine trash or debris is likely to snag or damage fishing equipment, or presents a hazard to navigation). The Lessee must notify DOI within 48 hours when recovery activities are: (i) not possible because conditions are unsafe; or (ii) not practicable because the marine trash and debris released is not likely to result in any of the conditions listed in (a) or (b) above. Notwithstanding this notification, DOI may still order the Lessee to recover the lost or discarded marine trash and debris if DOI finds the reasons provided by the Lessee in the notification unpersuasive. If the marine trash and debris is located within the boundaries of a potential archaeological resource/avoidance area, or a sensitive ecological/benthic resource area, the Lessee must contact DOI for approval before conducting any recovery efforts.

Recovery of the marine trash and debris should be completed as soon as practicable, but no later than 30 calendar days from the date on which the incident occurred. If the Lessee is not able to recover the marine trash or debris within 48 hours, the Lessee must submit a recovery plan to DOI explaining the recovery activities to recover the marine trash or debris (Recovery Plan). The Lessee must submit the Recovery Plan no later than 10 calendar days from the date on which the incident occurred. Unless

DOI objects within 48 hours of the filing of the Recovery Plan, the Lessee can proceed with the activities described in the Recovery Plan. The Lessee must request and obtain approval of a time extension if recovery activities cannot be completed within 30 calendar days from the date on which the incident occurred. The Lessee must enact steps to prevent similar incidents and must submit a description of these actions to BOEM and BSEE within 30 calendar days from the date on which the incident occurred.

5. **Reporting.** Report to DOI (OSWIncidentReporting@bsee.gov) all lost or discarded marine trash and debris. This report must be made monthly and submitted no later than the fifth day of the following month. The Lessee is not required to submit a report for those months in which no marine trash and debris was lost or discarded. The report must include the following:
 - Project identification and contact information for the Lessee;
 - operator, and/or contractor;
 - The date and time of the incident;
 - The lease number, OCS area and block, and coordinates of the object's location (latitude and longitude in decimal degrees NAD83);
 - A detailed description of the dropped object, including dimensions (approximate length, width, height, and weight) and composition (e.g., plastic, aluminum, steel, wood, paper, hazardous substances, or defined pollutants);
 - Pictures, data imagery, data streams, and/or a schematic/illustration of the object, if available;
 - An indication of whether the lost or discarded item could be: a magnetic anomaly of greater than 50 nanoTesla; a seafloor target of greater than 1.6 feet (0.5 meters) (m); or a sub-bottom anomaly of greater than 1.6 feet (0.5 m) when operating a magnetometer or gradiometer, side scan sonar, or sub-bottom profile in accordance with DOI's most recent, applicable guidance;
 - An explanation of how the object was lost; and
 - A description of immediate recovery efforts and results.
 - In addition to the foregoing, the Lessee must submit a report within 48 hours of the incident (48-hour Report) if the marine trash or debris could: (a) cause undue harm or damage to natural resources, including their physical, atmospheric, and biological components, with particular attention to marine trash or debris that could entangle, or be ingested by, marine protected species; or (b) significantly interfere with OCS uses (e.g., because the marine trash or debris is likely to snag or damage fishing equipment, or presents a hazard to navigation). The information in the 48-hour Report must be the same as that listed for the monthly report, but only for the incident that triggered the 48-hour Report. The Lessee must report to DOI if the object is recovered and, as applicable, describe any substantial variance from the activities described in the Recovery Plan that were required during the recovery efforts. The Lessee must include and address information on unrecovered marine trash and debris in the description of the site clearance activities provided in the decommissioning application required under 30 C.F.R. § 585.906.

PDC: Minimize Vessel Interactions with Listed Species - Use of a Moon Pool

During times of year when sea turtles are known to occur in the survey area and there is an intention to utilize a moon pool for the required activities, the following BMPs need to be followed

BMP. Closure of the Hull Door

- a. Should the moon pool have a hull door that can be closed, then prior to and following closure, the

moon pool must be monitored continuously by a dedicated crew observer with no other tasks to ensure that no individual protected species is present in the moon pool area. If visibility is not clear to the hull door from above (e.g., turbidity or low light), 30 minutes of monitoring is required prior to hull door closure.

- b. If a protected species is observed in the moon pool prior to closure of the hull door, the hull door must not be closed, to the extent practicable. If the observed animal leaves the moon pool, the operator may commence closure. If the observed animal remains in the moon pool, contact BSEE prior to closure of the hull doors according to reporting requirements (see *below* under *Reporting of Observations of Protected Species within an Enclosed Moon Pool*).

BMP. Reporting of Observations of Protected Species within an Enclosed Moon Pool

If a protected species is observed within an enclosed moon pool and does not demonstrate any signs of distress or injury or an inability to leave the moon pool of its own volition, measures described in this section must be followed (only in cases where they do not jeopardize human safety). Although this particular situation may not require immediate assistance and reporting, a protected species could potentially become disoriented with their surroundings and may not be able to leave the enclosed moon pool of their own volition. In order for operations requiring use of a moon pool to continue, the following reporting measures must be followed:

Within 24 hours of any observation, and daily after that for as long as an individual protected species remains within a moon pool (i.e., in cases where an ESA listed species has entered a moon pool but entrapment or injury has not been observed), The following information must be reported to BSEE (protectedspecies@bsee.gov):

- a. For an initial report, all information described above should be included.
- b. For subsequent daily reports:
 - o Describe the animal's status to include external body condition (e.g., note any injuries or noticeable features), behaviors (e.g., floating at surface, chasing fish, diving, lethargic, etc.), and movement (e.g., has the animal left the moon pool and returned on multiple occasions?);
 - o Description of current moon pool activities, if the animal is in the moon pool (e.g., drilling, preparation for demobilization, etc.);
 - o Description of planned activities in the immediate future related to vessel movement or deployment of equipment;
 - o Any additional photographs or video footage of the animal, if possible;
 - o Guidance received and followed from NMFS liaison or stranding hotline that was contacted for assistance;
 - o Whether activities in the moon pool were halted or changed upon observation of the animal; and
 - o Whether the animal remains in the pool at the time of the report, or if not, the time/date the animal was last observed.

BOEM does not advocate the lowering of crew members into the moon pool to free protected species and NMFS should be contacted if protected species are encountered in the moon pool.

PDC: Minimize Interactions with Listed Species during Geophysical Survey Operations

To avoid injury of and minimize any potential disturbance to protected species, implement the following measures for all vessels using boomer, sparker, bubble gun, and chirp sub-bottom profiler categories of equipment. Shutdown, pre-start clearance, and ramp-up procedures are not required during HRG survey operations using only other sources (e.g., ultra short baselines, fathometers, parametric shallow

penetration sub-bottom profilers, hull-mounted non-parametric sub-bottom profilers, side-scan sonars, pingers, acoustic releases, echosounders, and instruments attached to submersible vehicles (HOV/AUV/ROVs).

BMPs:

1. For situational awareness of marine mammals and ESA-listed species that may be in the survey area, during times third-party protected species observers (PSOs) are on duty, they must monitor to the farthest extent practicable, with a primary focus being 200 m around geophysical survey vessels (i.e., the Clearance Zone). At all times PSOs are on duty, any observed species must be recorded (see reporting requirements below).
2. Any observations of a marine mammal or ESA-listed species by crew members aboard any vessel associated with the survey must be relayed to the PSO on duty.
3. For autonomous surface vessels (ASV) that require remote PSO monitoring from the mother vessel⁸, a dual thermal/HD camera must be installed on the mother vessel facing forward and angled in a direction to provide a field of view ahead of the vessel and around the ASV. PSOs must be able to monitor the real-time output of the camera on hand-held computer tablets. Images from the cameras must be able to be captured and reviewed to assist in verifying species identification. A monitor must also be installed in the bridge displaying the real-time images from the thermal/HD camera installed on the front of the ASV itself, providing a further forward view of the craft. In addition, night-vision goggles with thermal clip-ons and a handheld spotlight must be provided and used such that PSOs can focus observations in any direction around the mother vessel and/or the ASV.
4. To minimize exposure of ESA-listed species of marine mammal to noise that could be disturbing, a 200 m Shutdown Zone for North Atlantic right whales and unidentified whales, and a 100 m Shutdown Zone for all other ESA-listed whales visible at the surface must be established around the sound source operating boomer, sparker, or bubble gun equipment. If the Shutdown Zone(s) cannot be adequately monitored for ESA-listed species presence (i.e. PSO discretion determines conditions, including night or other low visibility conditions, are such that listed species cannot be reliably sighted within the Shutdown Zone(s) with the available monitoring equipment, no equipment that requires PSO monitoring can be deployed until such time that the Shutdown Zone(s) can be effectively monitored.
5. The Shutdown Zone(s) must be monitored by third-party PSOs at all times when boomer, sparker, bubble gun, or Chirp sub-bottom profiler categories of equipment are being operated and all observed ESA-listed species must be recorded (see reporting requirements below).
6. If an ESA-listed whale is detected within or entering the respective Shutdown Zone, any boomer, sparker, or bubble gun categories of equipment that requires PSOs must be shut off until the minimum separation distance is re-established, and the clearance measures are carried out (200 m for North Atlantic right whales and 100 m for other ESA-listed whales).
7. A PSO must notify the survey crew that a shutdown of all active boomer, sparker, and bubble gun acoustic sources is immediately required. The vessel operator and crew must comply immediately with any call for a shutdown by the PSO. Any disagreement or discussion must occur only after shutdown.
8. For all protected species, Clearance Zones of 200 m for all ESA-listed species of marine mammal must be clear of all animals for 30 minutes before ramp-up or any deployed survey equipment is activated.

⁸ Lessees must discuss ASV deployment with BOEM prior to contracting to understand what measures may be necessary for the ASV system under consideration.

9. If any protected species is observed within the respective Clearance Zone during the 30-minute pre-clearance period, the relevant acoustic sources must not be initiated until the ESA listed whale (or unidentified whale) is confirmed by visual observation to have exited the relevant zone, or, until 30 minutes have elapsed with no further sighting of the animal
10. A “ramp up” of the boomer, sparker, or bubble gun survey equipment must occur at the start or re-start of geophysical survey activities when technically feasible. A ramp up must begin with the power for the geophysical survey equipment ramped up half power for 5 minutes, and then to full power.
11. Following a shutdown for any reason, ramp up of the equipment may begin immediately only if: (a) the shutdown is less than 30 minutes, (b) visual monitoring of the Shutdown Zone(s) continued throughout the shutdown, (c) the animal(s) causing the shutdown was visually followed and confirmed by PSOs to be outside of the Shutdown Zone(s) and heading away from the vessel, and (d) the Shutdown Zone(s) remains clear of all ESA-listed species. If all the conditions above are not met, a 500 m distance must be monitored for all ESA-listed species for 30 minutes of pre-clearance observation before noise-producing equipment can be turned back on.
12. No geophysical surveys may be conducted at night or during low-visibility conditions unless PSOs are able to effectively monitor the full extent of the Clearance and Shutdown Zone(s).
13. An Alternative Monitoring Plan (AMP) must be included with a pre-COP survey plan detailing the monitoring methodology that will be used during nighttime and low-visibility conditions. Surveys proposed in a COP must also include an AMP. The AMP must demonstrate how it will support effective monitoring for the presence of whales and sea turtles in the Clearance and Shutdown Zone(s). The AMP should include information about the distances that whales can be effectively detected using the identified technology/equipment, and any limitations posed by sea state(s) or vessel equipment (e.g., deck lights) that may inhibit the field of view.
14. The AMP must include technologies that have the technical feasibility to detect all ESA-listed species in the Clearance and Shutdown Zone(s). Low-light equipment (i.e., night-vision goggles and/or infrared technology) must be available for use during low visibility (e.g., inclement weather, nighttime) monitoring.
15. PSOs must be trained and experienced with any AMP technology used. The AMP must describe how calibration will be performed, for example, by including observations of known objects at set distances and under various lighting conditions. This calibration should be performed during mobilization and periodically throughout the survey operation.
16. PSOs shall make nighttime observations from a platform with no visual barriers, due to the potential for the reflectivity from bridge windows or other structures to interfere with the use of the night vision optics.
17. To minimize risk to North Atlantic right whales, no surveys may occur in Cape Cod Bay from January 1 - May 15 of any year (in an area beginning at 42°04'56.5" N-070°12'00.0" W; thence north to 42°12'00.0" N-070°12'00.0" W; thence due west to charted mean high-water line; thence along charted mean high water within Cape Cod Bay back to beginning point).
18. Boomer, sparker, bubble gun, or Chirp sub-bottom profiler sound sources used within the Southeast Right Whale Critical Habitat Unit 2 during the calving and nursing season (December-March) shall not operate at frequencies between 7 kHz and 35 kHz at night or poor visibility (i.e., anytime AMP methods are required).

19. During good conditions (e.g., daylight hours; Beaufort scale 3 or less) when survey equipment is not operating, to the maximum extent practicable (accounting for recommended shift schedules and vessel activities), PSOs should conduct observations for listed species for comparison of sighting rates and behavior with and without use of active geophysical survey equipment. Any observed listed species must be recorded regardless of any mitigation actions required.

PDC: Minimize Vessel Interactions with Listed Species

Ensure all vessels associated with any survey activities (transiting or actively surveying) comply with the vessel strike avoidance measures specified below. The only exception is when the safety of the vessel or crew necessitates deviation from these requirements. If any such incidents occur, they must be reported as outlined below.

BMPs:

1. Vessel captain and crew must maintain a vigilant watch for all protected species and reduce speed, stop their vessel, or alter course, as appropriate and regardless of vessel size, to avoid striking any listed species. The presence of a single individual at the surface may indicate the presence of submerged animals in the vicinity; therefore, precautionary measures should always be exercised. If pinnipeds or small delphinids of the following genera: *Delphinus*, *Lagenorhynchus*, *Stenella*, and *Tursiops* are visually detected approaching the vessel (i.e., to bow ride) or towed equipment, vessel speed reduction, course alteration, and shutdown are not required.
2. Anytime a survey vessel is underway (transiting or surveying), a PSO must monitor for protected species, and the vessel must maintain a minimum separation distance of 500 m or greater from any sighted ESA-listed species, or other unidentified large marine mammal visible at the surface, to ensure detection of that animal in time to take necessary measures to avoid striking the animal. If the survey vessel does not require a PSO for the type of survey equipment used, crew may be used as a Trained Lookout to meet this requirement. For monitoring around ASVs controlled from a manned vessel⁹, regardless of the equipment it may be operating, a dual thermal/HD camera must be installed on the mother vessel facing forward and angled in a direction so as to provide a field of view ahead of the vessel and around the ASV. A dedicated operator must be able to monitor the real-time output of the camera on hand-held computer tablets. Images from the cameras must be able to be captured and reviewed to assist in verifying species identification. A monitor must also be installed in the bridge displaying the real-time images from the thermal/HD camera installed on the front of the ASV itself, providing a further forward view of the craft.
 - a. Survey plans must include identification of the PDCs for vessel strike avoidance measures, including procedures for equipment shut down and retrieval, communication between PSOs/Trained Lookouts, equipment operators, and the captain, and other measures necessary to avoid vessel strikes while maintaining vessel and crew safety. If any circumstances are anticipated that may preclude the implementation of this PDC, they must be clearly identified in the survey plan and alternative procedures outlined in the plan to ensure minimum distances are maintained and vessel strikes can be avoided.

⁹ Lessees must discuss ASV deployment with BOEM prior to contracting to understand what measures may be necessary for the ASV system under consideration.

- b. All vessel crew members must be briefed in the identification of protected species that may occur in the survey area and in regulations and best practices for avoiding vessel collisions. Reference materials must be available aboard all project vessels for identification of listed species. The expectation and process for reporting of protected species sighted during surveys must be clearly communicated and posted in highly visible locations aboard all project vessels, so that there is an expectation for reporting to the designated vessel contact (such as the lookout or the vessel captain), as well as a communication channel and process for crew members to do so.
 - c. A minimum separation distance of 500 m from all ESA-listed whales (including unidentified large whales) must be maintained around all surface vessels at all times.
 - d. If a large whale is identified within 500 m of the forward path of any vessel, the vessel operator must steer a course away from the whale at 10 knots (18.5 km/hr) or less until the 500 m minimum separation distance has been established. Vessels may also shift to idle if feasible.
 - e. If a large whale is sighted within 200 m of the forward path of a vessel, the vessel operator must reduce speed and shift the engine to neutral. Engines must not be engaged until the whale has moved outside of the vessel's path and beyond 500 m. If stationary, the vessel must not engage engines until the large whale has moved beyond 500 m.
 - f. If a sea turtle or manta ray is sighted at any distance within the operating vessel's forward path, the vessel operator must slow down to 4 knots and steer away (unless unsafe to do so). The vessel may resume normal vessel operations once the vessel has passed the individual.
 - g. Vessels must avoid transiting through areas of visible jellyfish aggregations or floating vegetation (e.g., sargassum lines or mats) that are easily sighted and exceed 50 meters in length or width. In the event that operational safety prevents avoidance of such areas, vessels must slow to 4 knots while transiting through such areas.
 - h. Vessels operating in water depths with less than four feet of clearance between the vessel and the bottom should maintain speeds no greater than 4 kts to minimize risk of vessel strikes on sturgeon and sawfish.
3. Any observations of a marine mammal or ESA-listed species by crew members aboard any vessel associated with the survey must be relayed to the PSO on duty and/or captain of the vessel.
 4. To monitor the minimum separation distance, a PSO (or Trained Lookout if PSOs are not required) must be posted during all times a vessel is underway (transiting or surveying) to monitor for listed species within a 180-degree direction of the forward path of the vessel (90 degrees port to 90 degrees starboard).
 - a. Visual observers monitoring the minimum separation distance can be either PSOs or Trained Lookouts (if PSOs are not required). If the Trained Lookout is a vessel crew member, this must be their designated role and primary responsibility on shift. Any crew designated as Trained Lookouts must receive training on protected species identification, vessel strike minimization procedures, how and when to communicate with the vessel captain, and reporting requirements. All observations must be recorded per reporting requirements.
 - b. Regardless of monitoring duties, all crew members responsible for navigation duties must receive site-specific training on ESA-listed species sighting/reporting and vessel strike avoidance measures.
 - c. Vessels underway must not divert their course to approach any ESA-listed species and marine mammals.

5. Regardless of vessel size, vessel operators must reduce vessel speed to 10 knots (18.5 mph) or less while operating in any Seasonal Management Area (SMA) and Dynamic Management Area (DMA) or Slow Zone triggered by visual detections of North Atlantic right whales. An exception to this requirement is for vessels operating in areas within a portion of a visually designated DMA or Slow Zone where it is not reasonable to expect the presence of North Atlantic right whales (e.g., Long Island Sound, shallow harbors), unless a sighting of a North Atlantic right whale in that area triggered the DMA/Slow Zone.
6. BOEM encourages increased vigilance through the required best management practices to minimize vessel interactions with protected species, by reducing speeds to 10 knots or less when operating within an acoustically triggered Slow Zone, and when feasible, avoid operating in or transiting through Slow Zones.
7. Ensure all vessel operators check for information regarding mandatory or voluntary ship strike avoidance (SMAs and DMAs (or Slow Zones) and daily information regarding North Atlantic right whale sighting locations. These media may include, but are not limited to: NOAA weather radio, U.S. Coast Guard NAVTEX and channel 16 broadcasts, Notices to Mariners, the Whale Alert app, or WhaleMap website.
 - a. North Atlantic right whale Sighting Advisory System info can be accessed at: <https://apps-nefsc.fisheries.noaa.gov/psb/surveys/MapperiframeWithText.html>.
 - b. Information about active SMAs, DMAs, and Slow Zones can be accessed at: <https://www.fisheries.noaa.gov/national/endangered-species-conservation/reducing-vessel-strikes-north-atlantic-right-whales>.

PDC: Entanglement Avoidance

Ensure any mooring systems used during data collection activities are designed to prevent potential entanglement or entrapment of listed species, and in the unlikely event that entanglement does occur, ensure proper reporting of entanglement events according to the measures specified below.

BMPs:

1. Ensure that any buoys attached to the seafloor use the best available mooring systems. Buoys, lines (chains, cables, or coated rope systems), swivels, shackles, and anchor designs must prevent any potential entanglement of listed species while ensuring the safety and integrity of the structure or device.
2. All mooring lines and ancillary attachment lines must use one or more of the following measures to reduce entanglement risk: shortest practicable line length, rubber sleeves, weak-links, chains, cables, or similar equipment types that prevent lines from looping, wrapping, or entrapping protected species.
3. Any equipment must be attached by a line within a rubber sleeve for rigidity. The length of the line must be as short as necessary to meet its intended purpose.
4. When practicable, buoys should be lowered and raised slowly to minimize risk to listed species and benthic habitat. No buoys should be deployed or retrieved if large whales or sea turtles are sighted within 500 m of the buoy being deployed/retrieved.
5. If a live or dead marine protected species becomes entangled, operators must immediately contact the applicable stranding network coordinator using the reporting contact details (see Reporting Requirements section) and provide any on-water assistance requested.
6. All buoys must be properly labeled with owner and contact information.

PDC: Protected Species Observers

The Lessee must use qualified third-party PSOs to observe Clearance and Shutdown Zones, and implement mitigation measures as outlined in the conditions above.

BMPs:

1. All PSOs must have completed a training program with BOEM-approved PSO training materials. PSOs must also have received NMFS approval to act as a PSO for geophysical surveys. The Lessee must provide to BOEM upon request, documentation of NMFS approval as PSOs for geophysical activities in the Atlantic and copies of the most recent training certificates of individual PSOs' successful completion of a commercial PSO training course with an overall examination score of 80% or greater. Instructions and application requirements to become a NMFS- approved PSO can be found at: <https://www.fisheries.noaa.gov/national/endangered-species-conservation/protected-species-observers>.
2. For situations where Trained Lookouts are used when PSOs are not required, training must include protected species identification, vessel strike minimization procedures, how and when to communicate with the vessel captain, and reporting requirements
3. PSOs deployed for mitigation, monitoring, and reporting of geophysical survey activities must be employed by a third-party observer provider. While the vessel is underway, they must have no other tasks other than to conduct observational effort, record data, communicate with and instruct relevant vessel crew to the presence of listed species and implement required PDCs and BMPs. PSOs on duty must be clearly listed on daily data logs for each shift.
 - a. Non-third-party observers may be approved by NMFS on a case-by-case basis for limited, specific duties in support of approved, third-party PSOs.
4. A minimum of one PSO must be observing for listed species on each vessel at all times that noise-producing equipment is operating, or the survey vessel is actively transiting. The Lessee must include a PSO schedule showing that the number of PSOs used is sufficient to effectively monitor the affected area for the project (e.g., surveys) and record the required data. PSOs must not be on watch for more than 4 consecutive hours, with at least a 2-hour break after a 4-hour watch. PSOs must not work for more than 12 hours in any 24-hour period.
5. Visual monitoring must occur from the most appropriate vantage point on the associated operational platform that allows for maximum possible 360-degree field of view around the sound source and vessel. If 360-degree field of view is not possible from a single vantage point, multiple PSOs must be on watch to ensure such coverage to ensure both geophysical survey and vessel strike avoidance requirements for ESA-listed species can be implemented.
6. The Lessee must ensure that suitable equipment is available to each PSO to adequately observe the full extent of the Clearance and Shutdown Zones prior to and during all geophysical survey activity respectively and meet all reporting requirements. The following equipment must be available.
 - a. Visual observations must be conducted using binoculars and the naked eye while free from distractions and in a consistent, systematic, and diligent manner.
 - b. Rangefinders (at least one per PSO, plus backups) or reticle binoculars
 - c. 7 x 50) of appropriate quality (at least one per PSO, plus backups) to estimate distances to listed species located in proximity to the Clearance and Shutdown Zone(s).
 - d. Digital cameras with a telephoto lens that is at least 300 mm or equivalent on a full-frame single lens reflex (SLR). The camera or lens should also have an image stabilization system. Used to record sightings and verify species identification when possible.

- e. A laptop or tablet to collect and record data electronically.
- f. Global Positioning Units (GPS) if data collection/reporting software does not have built-in positioning functionality.
- g. PSO data must be collected in accordance with standard data reporting, software tools, and electronic data submission standards approved by BOEM and NMFS for the particular activity.
- h. Any other tools deemed necessary to adequately perform PSO tasks.

PDCs: Reporting Requirements

To ensure compliance and evaluate effectiveness of mitigation measures, regular reporting of survey activities and information on listed species will be required as follows. Only vessel surveys which require third-party PSOs will be required to meet reporting requirements under the BMPs 1-4. Reporting requirements listed as BMPs 5 and 6 must be completed if applicable regardless of survey type or type of observer.

BMPs:

1. Monthly reporting of raw PSO data of geophysical survey activities must be submitted to BOEM (at renewable_reporting@boem.gov) and BSEE at (OSWSubmittals@bsee.gov) by the PSO provider on the 15th of each month for each vessel conducting survey work. Any editing, review, and quality assurance checks must be completed only by the PSO provider prior to submission to BOEM and ensure use of standard field codes and formats (Attachment A). Monthly data reporting from all PSO observations must be recorded based on standard PSO collection and reporting requirements. PSOs must use standardized electronic data forms to record data. The PSOs may record data electronically in data collection software, but the data fields listed below must be recorded and exported to an Excel file for submittal. Alternatively, BOEM has developed an Excel spreadsheet with all the necessary data fields that is available upon request.
2. Final survey reports must be submitted to BOEM in coordination with PSOs within 90 calendar days following completion of a survey. Final reports must contain all survey activity included under each submitted survey plan, but include individual vessel departure and return ports, PSO names and training certifications, the PSO provider contact information, dates of the survey, a vessel track, a summary of all PSO documented sightings of protected species, survey equipment shutdowns that occurred, any vessel strike-avoidance measures taken, takes of protected species that occurred, and any observed injured or dead protected species. The DOI will work with the Lessee to ensure that DOI does not release confidential business information found in the monitoring reports.
3. PSOs must be approved by NMFS prior to the start of a survey, and the Lessee must submit documentation of NMFS' approval upon request to BOEM (at renewable_reporting@boem.gov) and BSEE at (OSWSubmittals@bsee.gov). Application requirements to become a NMFS-approved PSO for geological and geophysical surveys can be obtained by sending an inquiry to nmfs.psoreview@noaa.gov.
4. Instructions for Geophysical Survey Reports. The following data fields for PSO reports of geological and geophysical surveys must be reported in Excel format (.xml file) along with metadata defining all data fields.

Survey Information:

- Project name
- Lease number
- State Coastal Zones

- Survey Contractor
- Survey Type
- Reporting start and end dates
- Visual monitoring equipment used (e.g., bionics, magnification, IR cameras, etc.)
- Distance finding method used
- PSO names (last, first), training certification, and affiliation
- PSO location and observation height above sea surface

Operations Information:

- Vessel name(s)
- Sound sources including equipment type, power levels, and frequencies used
- Greatest RMS source level
- Dates of departures and returns to port with port name

Monitoring Effort Information:

- Date (YYYY-MM-DD)
- Source status at time of observation (on/off)
- Number of PSOs on duty
- Start time of observations for each shift in UTC (YY-MM-DDT HH:MM)
- End time of observations for each shift in UTC (YY-MM-DDT HH:MM)
- Duration of visual observations of protected species
- Weather
- Wind speed (knots), direction (cardinal direction)
- Beaufort sea state
- Water depth (meters)
- Visibility (km)
- Glare severity related to monitoring area (none, slight, moderate, extreme)
- Time pre-clearance visual monitoring began in UTC (YY-MM-DDT HH:MM)
- Time pre-clearance monitoring ended in UTC (YY-MM-DDT HH:MM)
- Duration of pre-clearance visual monitoring
- Time of day of pre-clearance began (day/night)
- Time power-up/ramp-up began
- Time equipment full power was reached
- Duration of power-up/ramp-up (if conducted)
- Time survey activity began (equipment on) in UTC

- Time survey activity ended (equipment off) in UTC
- Survey Duration
- Did a shutdown/power-down occur?
 - Time shutdown was called for (UTC)
 - Time equipment was shut down (UTC)
- Vessel location (latitude/longitude, decimal degrees) when survey effort begins and ends; vessel location at beginning and end of visual PSO duty shifts; recorded at :30 intervals if obtainable from data collection software
- Habitat or prey observations (narrative)
- Marine debris sightings (narrative)

Detection Information (in addition to the Survey, Operation, and Monitoring fields)

- Date (YYYY-MM-DD)
- Sighting ID (multiple sightings of the same animal or group should use the same ID)
- Time at first detection in UTC (YY-MMDDT HH:MM)
- Time at last detection in UTC (YY-MM-DDT HH:MM)
- PSO name(s) (Last, First) on duty
- Observer location
- Number of observes on duty
- Watch Status (On effort PSO, off effort PSO, opportunistic, crew, alternate vessel/platform)
- Effort (ON=Device On; OFF=Device Off)
- Start time of observations
- End time of observations
- Location of vessel when detection occurs: Latitude and Longitude (decimal degrees)
- Compass heading of vessel (degrees)
- Beaufort sea state
- Wind speed (knots/direction)
- Swell Height (meters)
- Weather/Precipitation
- Visibility (kilometers)
- Cloud coverage (%)
- Glare severity related to monitoring area (none, slight, moderate, extreme)
- Visibility (kilometers)
- Cloud coverage (%)
- Glare severity related to monitoring area (none, slight, moderate, extreme)

- Species (Species Code)
 - Certainty of identification
 - Number of adults (high, low, best)
 - Number of juveniles (high, low, best)
 - Total number of animals or estimated group size
 - Sighting cue (Blow, Breach, White water, Flukes, Body)
 - Bearing to animal(s) when first detected (ship heading in degrees + clock face direction to animal)
 - Distance determination method (use code)
 - Distance from vessel (e.g., reticle distance in meters)
 - Description of unidentified animals (include features such as overall size; shape of head; color and pattern; size, shape, and position of dorsal fin; height, direction, and shape of blow, etc.)
 - Detection narrative (note behavior, especially changes in relation to survey activity and distance from source vessel)
 - Direction of travel/first approach (relative to vessel)
 - Behaviors observed: indicate behaviors and behavioral changes observed in sequential order (use behavioral codes)
 - If any bow-riding behavior observed, record total duration during detection (YY-MM-DDT HH:MM)
 - Initial heading of animal(s) (ship heading in degrees + clock face direction to animal)
 - Final heading of animal(s) (ship heading in degrees + clock face direction to animal)
 - Shutdown zone size during detection (meters)
 - Was the animal inside the shutdown zone? (Y/N)
 - Closest distance to vessel (reticle distance in meters)
 - Time at closest approach (UTC YY-MM-DDT HH:MM)
 - Time animal entered shutdown zone (UTC YY-MM-DDT HH:MM)
 - Time animal left shutdown zone (UTC YY-MM-DDT HH:MM)
 - If observed/detected during ramp-up/power-up: first distance (reticle distance in meters), closest distance (reticle distance in meters), last distance (reticle distance in meters), behavior at final detection
 - Did a shutdown/power-down occur? (Y/N)
 - Time shutdown was called for (UTC)
 - Time equipment was shut down (UTC)
1. Protected Species Incident Reporting. Regardless of survey type or the need to provide a dedicated trained watch stander or PSO, any potential take, strikes, or dead/injured protected species caused by Project activities must be reported to the NMFS GARFO Protected Resources Division nmfs.gar.incidental-take@noaa.gov, NOAA Fisheries 24-hour Stranding Hotline – for marine mammals from Maine-Virginia, report to (866) 755-6622, and from North Carolina-Florida to (877) 942-5343 and for sea turtles from Maine-Virginia, report to (866) 755-6622, and from North

Caroline-Florida to (844)732-8785. BOEM (at mailto:renewable_reporting@boem.gov), and BSEE (at <mailto:protectedspecies@bsee.gov>) as soon as practicable, but no later than 24 hours from the time the incident took place (Protected Species Incident Report). The Protected Species Incident Report must include the following information: protectedspecies@bsee.gov as soon as practicable, but no later than 24 hours from the time the incident took place (Protected Species Incident Report). The Protected Species Incident Report must include the following information:

- Contact info for the person providing the report;
 - Time, date, and location (latitude/longitude) of the incident;
 - Species identification (if known) or description of the animal(s) involved;
 - Condition of the animal(s) (e.g., live, injured, dead);
 - Observed behaviors of the animal(s), if alive;
 - If available, photographs or video footage of the animal(s); and
 - General circumstances (e.g. vessel speed/direction of travel, sound sources in use) under which the animal was impacted.
2. **Dead or Injured Protected Species Reporting.** All dead or injured protected species, must be reported regardless of whether they were observed during operations or directly due to Lessee activities. In the event that an injured or dead marine mammal or sea turtle is sighted, regardless of the cause, the Lessee must report the incident to the NMFS Protected Resources Division (nmfs.gar.incidental-take@noaa.gov), NMFS 24-hour Stranding Hotline number (866-755-6622), BOEM (at renewable_reporting@boem.gov), and BSEE (at protectedspecies@bsee.gov) as soon as practicable (taking into account crew and vessel safety), but no later than 24 hours from the sighting (Dead or Injured Protected Species Report). Staff responding to the hotline call will provide any instructions for the handling or disposing of any injured or dead protected species by individuals authorized to collect, possess, and transport sea turtles. The Protected Species Incident Report must include the following information:
- Time, date, and location (latitude/longitude) of the first discovery (and updated location information if known and applicable);
 - Species identification (if known) or description of the animal(s) involved;
 - Condition of the animal(s) (including carcass condition if the animal is dead);
 - Observed behaviors of the animal(s), if alive;
 - If available, photographs or video footage of the animal(s); and
 - General circumstances under which the animal was discovered.

Attachment A: Standard Field Codes And Units

Beaufort Scale

Beaufort	Description of Sea State
0	Windless: Glassy sea surface, 0 knot winds, 0-meter swell
1	Calm, light air: Ripples, no white caps, 1-3 knot winds, 0.1-meter swells
2	Light breeze: Short, small wavelets that don't break, 4-6 knot winds, 0.2-0.3-meter swells
3	Gentle breeze: Large wavelets that begin to break, 7-10 knot winds, 0.6-1-meter swells
4	Moderate breeze: Small waves with frequent white caps, 11-16 knot winds, 1-1.5-meter swells
5	Fresh breeze: Long, moderate waves with many white caps, 17-21 knot winds, 2-2.5-meter swells
6	Strong breeze: Large waves with extensive foaming and some spray, 22-27 knot winds, 3-4-meter swells
7	Near gale: Sea heaps up, waves breaking, streaks forming, 28-33 knot winds, 4-4.5-meter swells
8	Gale: Moderately high waves of great length, well-marked streaks, 34-40 knot winds, 5.5-7.5-meter swells
9	Severe gale: High waves, dense streaking, spray may affect visibility, 41-47 knot winds, 7-10-meter swells
10	Storm: Very high waves with long over-hanging crests, sea becoming white with streaks, 48-55 knot winds, 9-12.5-meter swells
11	Violent storm: Exceptionally high waves, sea completely covered with foam, 56-63 knot winds, 11.5-12.5-meter swells
12	Hurricane: Air filled with foam and spray, sea completely white, no visibility, 63+ knot winds, 16+ meter swells

Units

Date	YYYY-MM-DD
Durations (e.g., start and end times) (Coordinated Universal Time, UTC)	YY-MM-DDT HH:MM
Wind Speed	Knots (kt)
Distance, height, and depth	Meters (m) or kilometers (km)
Position in Latitude and longitude	Decimal degrees (North American Datum of 1983 (NAD83); e.g., dd.ddddd, dd.ddddd)
Bearing or direction of travel	Ship heading + clock face to animal

Cloud Cover Code	Percent (%) of sky covered with clouds:
1	<10%
2	10–50%
3	50–90%
4	>90%

Monitoring Equipment

Code	Equipment	Code	Equipment
HB	Hand-held Binoculars	IG	Infrared Goggles
BE	Big Eyes	CR	Crew Reported (any method)
NE	Naked Eye	PT	Passive Acoustic Towed Array
IC	Infrared Camera	PA	Passive Acoustic Moored/Stationary

Distance Finding

Code	Distance Finding Method
EST	Eye estimation
RET	Reticle
LAS	Laser range-finder
RFS	Range-finding stick or calipers

Species Identification

Code	ITIS	WoRMS APHIA	Common name	Scientific name
Marine Mammals				
ASDO	552460	137108	Atlantic spotted dolphin	<i>Stenella frontalis</i>
WSDO	180443	137100	Atlantic white-sided dolphin	<i>Lagenorhynchus acutus</i>
BLBW	180517	137122	Blainville's beaked whale	<i>Mesoplodon densirostris</i>
BLWH	180528	137090	Blue whale	<i>Balaenoptera musculus</i>
BODO	180426	137111	Bottlenose dolphin	<i>Tursiops truncatus</i>
BRWH	180525	242603	Bryde's whale	<i>Balaenoptera edeni</i>
GOBW	180498	137127	Cuvier's beaked whale	<i>Ziphius cavirostris</i>
DSWH	180492	159025	Dwarf sperm whale	<i>Kogia sima</i>
FKWH	180463	137104	False killer whale	<i>Pseudorca crassidens</i>
FIWH	180527	137091	Fin whale	<i>Balaenoptera physalus</i>
BEBW	180509	137123	Gervais' beaked whale	<i>Mesoplodon europaeus</i>
HAPO	180473	137117	Harbor Porpoise	<i>Phocoena phocoena</i>
HUWH	180530	137092	Humpback whale	<i>Megaptera novaeangliae</i>
KIWH	180469	137102	Killer whale	<i>Orcinus orca</i>
MANA	180684	159504	Manatee	<i>Trichechus manatus</i>
MHWH	180459	137103	Melon-headed whale	<i>Peponocephala electra</i>
MIWH	180524	137087	Minke whale	<i>Balaenoptera acutorostrata</i>
RIWH	180537	159023	North Atlantic right whale	<i>Eubalaena glacialis</i>

Code	ITIS	WoRMS APHIA	Common name	Scientific name
NBWH	180504	343899	Northern bottlenose whale	<i>Hyperoodon ampullatus</i>
SPDO	180430	137105	Pantropical spotted dolphin	<i>Stenella attenuata</i>
SFPW	552461	137097	Pilot whale (shortfinned)	<i>Globicephala macrorhynchus</i>
LFPW	180466	137096	Pilot whale (longfinned)	<i>Globicephala melas</i>
PYKW	180461	137095	Pygmy killer whale	<i>Feresa attenuata</i>
PSWH	180491	137113	Pygmy sperm whale	<i>Kogia breviceps</i>
GRAM	180457	137098	Risso's dolphin	<i>Grampus griseus</i>
RTDO	180417	137110	Rough-toothed dolphin	<i>Steno bredanensis</i>
SEWH	180526	137088	Sei whale	<i>Balaenoptera borealis</i>
SADO	180438	137094	Short-beaked common dolphin	<i>Delphinus delphis</i>
SOBW	180515	137121	Sowerby's beaked whale	<i>Mesoplodon bidens</i>
SPWH	180488	137119	Sperm whale	<i>Physeter macrocephalus</i>
STDO	180434	137107	Striped dolphin	<i>Stenella coeruleoalba</i>
TRBW	180508	137126	True's beaked whale	<i>Mesoplodon mirus</i>
WBDO	180442	137101	White-beaked dolphin	<i>Lagenorhynchus albirostris</i>
Seals				
GRSE	180653	137080	Gray seal	<i>Halichoerus grypus</i>
HASE	180649	137084	Harbor seal	<i>Phoca vitulina</i>
HGSE	622022	159019	Harp seal	<i>Pagophilus groenlandicus</i>
HOSE	180657	137078	Hooded seal	<i>Cystophora cristata</i>
Sea Turtles				
LHST	173833	137206	Loggerhead sea turtle	<i>Caretta caretta</i>
LBST	173836	137207	Leatherback sea turtle	<i>Dermochelys coriacea</i>
KRST	551770	137208	Kemp's ridley sea turtle	<i>Lepidochelys kempii</i>
HBST	173843	137209	Hawksbill sea turtle	<i>Eretmochelys imbricata</i>
GRST	173830	137205	Green sea turtle	<i>Chelonia mydas</i>
Fish				
MARA	—	1026118	Giant manta ray	<i>Manta birostris</i>
STUR	—	—	Atlantic sturgeon	<i>Acipenser oxyrinchus oxyrinchus</i>
Unidentified Species				
UNID	—	—	Unidentified animal	—
UNBA	180403	2688	Unidentified baleen whale	—
UNBW	180493	136986	Unidentified beaked whale	—
UNTU	173828	136999	Unidentified turtle	—
UNLW	180403	2688	Unidentified large whale	—
UNTW	180404	148723	Unidentified odontocete	—
UNSE	—	—	Unidentified seal	—
KOGI	180490	159024	Unidentified Kogia spp.	—
PIWH	180464	137017	Unidentified pilot whale	—

Behavioral/State

Code	Behavior/state	Code	Behavior/state
14	acrobatic	78	milling
25	blowing	22	motionless at surface
12	bow riding	11	porpoising
13	breaching	90	SAG
05	injured (e.g., visible wound)	21	spy hopping
00	dead	19	surfacing
03	dead in fishing gear	17	swimming at surface (non-travel)
23	diving (mammal)	18	swimming below surface
69	diving (turtle)	20	tail slapping (lobtailing)
07	diving fluke up	16	travel (slow <1 kt)
92	entangled in lines, ropes, gear	07	travel (moderate 1–10 kt)
54	feeding	06	fast travel >10 kt
22	logging	94	undetermined

Appendix B QA/QC Checklist for Completing ESA Biological Assessments

- Cross-walk activities identified in the COP, Draft EIS, MMPA ITA application, and USACE permit with the activities identified in the description of the Proposed Action.
- Confirm all ESA listed species that the developer has requested take authorization for through the MMPA are addressed consistently in the BA.
- Cross-walk activities addressed in the Effects of the Action with the Description of the Proposed Action to ensure consistency and that no new information is being introduced in the Effects of the Action section.
- Confirm all mitigation and monitoring measures and/or special conditions identified by the developer in the COP and MMPA ITA application and that BOEM, USACE, USEPA or any other action agency is proposing to require and are considered part of the Proposed Action are clearly identified in the BA.
- Confirm that the action area takes into consideration all planned activities described in the BA (particularly vessel transit routes). Review the [GARFO Section 7 mapper](#) and the [SERO section 7 mapper](#) to confirm that all species and critical habitat that occur in the action area are addressed in the BA.
- Review the [ESA Info Needs](#) document to confirm that all necessary information has been included in the BA and that NMFS recommended acoustic thresholds are used. Note the Info Needs document is a living document and the online version should always be used to ensure the current version.
- Ensure the [NMFS OPR Multi-species Noise Calculator](#) “User Spreadsheet Tool” is used for in/nearshore pile driving when assessing effects to marine mammals, fish and sea turtles.

Appendix C NMFS/BOEM ESA/MMPA Alignment Process for Offshore Wind Energy Projects

C.1 ESA Milestone 1 - Preliminary Draft BA

Documents Required: Preliminary Draft BA from BOEM; Cooperating Agency Draft EIS; MMPA ITA application

- Submitted to GAR PRD at the beginning of the cooperating agency review of the Draft EIS (ESA Milestone 1).
- BOEM will ensure the description of the Proposed Action in the BA is consistent with the action described in the lessee's application for an MMPA Incidental Take Authorization (ITA).
 - Internal process notes:
 - NMFS PR1 crosswalks the MMPA application with the Draft EIS.
 - MMPA application and COP updates need to be reflected in both documents. Communicate to developer that this alignment is necessary.
 - Draft EIS and BA needs to reflect what is in the COP and MMPA application.
- The draft BA will include a clear description of all measures that are part of the Proposed Action and clearly identify them by category (e.g., measures proposed by US Wind, measures to be required by BOEM, measures proposed as special conditions of a USACE permit, measures to be included in the proposed MMPA ITA (to the extent that information is available at the time the BA is submitted to GAR PRD), etc.). This will help to identify which agency has relevant regulatory and/or enforcement authority for each measure.
- BOEM will reference PR1's consideration of an application for an MMPA ITA (as a Co-action Agency). At this stage, the BA will reference the LOA application PR1 has determined to be complete if PR1 has not yet published a proposed ITA.

C.2 ESA Milestone 2 - Consultation Initiation Package

Documents Required: Final BA from BOEM; Draft EIS; draft proposed MMPA ITA from PR1

Consideration of Mitigation Measures

In addition to describing the avoidance/minimization/monitoring measures that are part of the Proposed Action (e.g., included in US Wind's proposal and/or measures proposed to be required by BOEM through COP approval or in the USACE permit), the BA will reference PR1's proposed ITA and state that it incorporates the proposed ITA's marine mammal mitigation and monitoring measures for the period of time to be covered by the ITA unless there is a conflict or different level of protection provided by similar measures such that:

- Any measure BOEM is considering that is more protective of marine mammals would take precedence over a similar measure in the ITA for purposes of the Section 7 analysis;
- Any measure PR1 is proposing that is more protective of marine mammals would take precedence over a similar measure identified by BOEM for purposes of the Section 7 analysis (in consideration of the duration of the ITA).

C.3 ESA/MMPA Coordination Points for GARFO/PR1/BOEM

- Prior to submitting comments on the preliminary draft BA, GAR PRD will coordinate with PR1 on the scope of the Proposed Action considered in the draft BA (including mitigation and monitoring measures) to identify any potential inconsistencies between the action as described in the preliminary draft BA and the MMPA ITA application. Any such inconsistencies will be provided to BOEM in GAR PRD's comments to BOEM on the draft BA. As necessary, following the submission of comments on the preliminary draft BA, BOEM and NMFS (GAR PRD and PR1) will work to expeditiously resolve inconsistencies between the action as described in the draft BA and the MMPA ITA application, with the goal of resolving any issues in the revised BA submitted to GAR PRD. This will include resolving any issues related to the activities and species considered and with the proposed mitigation and monitoring conditions being considered by PR1 for the proposed ITA.
- As necessary, before the revised BA is submitted, a coordination meeting will be held to review the scope of the Proposed Action (i.e., the activities to be considered in the ESA consultation) and measures proposed to be required by BOEM and PR1 through their respective authorities.
 - The goal of this meeting is to identify and resolve any inconsistencies and addresses any other questions/concerns regarding the marine mammal mitigation and monitoring measures prior to initiation of the ESA consultation so that GAR PRD has a clear understanding of how to analyze the "effects of the action" (i.e., the effects of BOEM's action plus the effects of PR1's ITA as well as other actions/activities that would not occur but for BOEM's action).
 - This meeting should occur as early as practicable prior to the date GAR PRD is scheduled to confirm it has all the information it needs to initiate consultation with respect to established FAST-41 deadlines.
- BOEM, PR1, and GAR PRD agree that consultation will not be initiated until any identified inconsistencies and other questions/concerns regarding marine mammal mitigation and monitoring measures are resolved to the extent possible given the different statutory requirements. This will also need to take FAST-41 deadlines into account.
- Once consultation is initiated, GAR PRD will share a draft "Description of the Proposed Action" including the proposed mitigation measures considered part of the Proposed Action, with BOEM and PR1 for review and identification of any concerns or inconsistencies with each agency's understanding of the Proposed Action. BOEM will ensure review of other action agencies (i.e., USACE, USEPA, USCG). This will be done as early as possible during the consultation period.

As mitigation measures evolve during the consultation period, BOEM, GAR PRD, and PR1 will continue coordination and discussion as necessary